

ORIGINAL



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**SALT RIVER PROJECT**

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Manager, Regulatory Affairs & Contracts

January 31, 2011

Arizona Corporation Commission  
**DOCKETED**

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Mr. Steve Olea  
Director, Utilities Division  
Arizona Corporation Commission  
1200 W. Washington Street  
Phoenix, AZ 85007

Re: Ten-Year Plan – Seventh Biennial Electric Transmission Assessment for 2012 through 2021; Docket No. E-00000D-11-0017

Dear Mr. Olea:

Enclosed are an original and thirteen (13) copies of The Salt River Project's 2011-2020 Ten-Year Transmission Plan filed pursuant to A.R.S. Section §40-360-02.

Please contact Mr. Jim Pratt, Manager, Transmission Planning Department at (602) 236-5385 if you have any questions concerning this plan.

Sincerely,

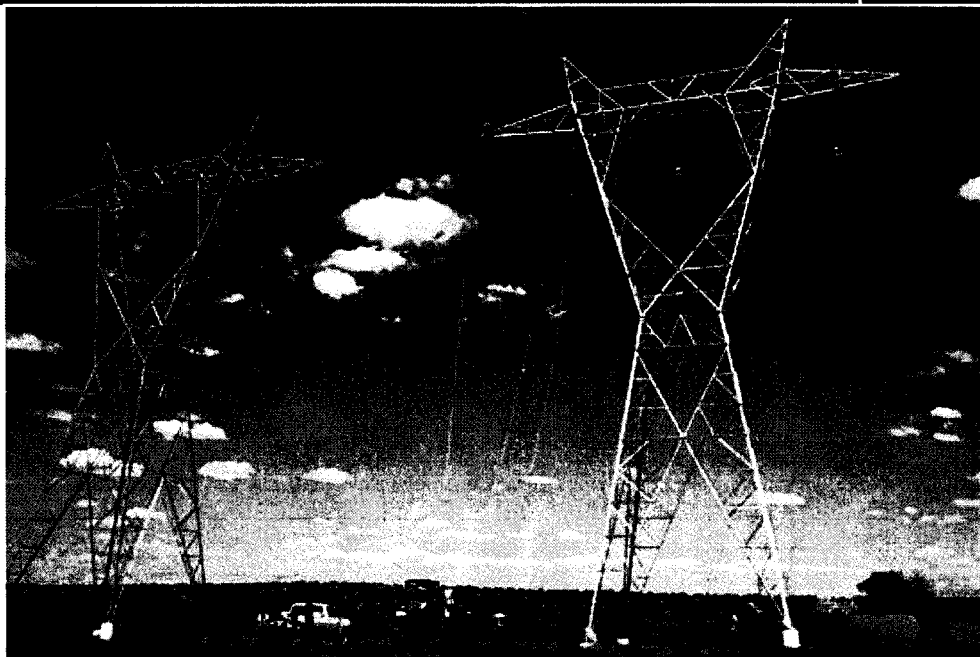
Kelly J. Barr

KJB/jkb

Enclosures (14)

# 2011

## Salt River Project Ten Year Plan Transmission Projects 2011-2020



Prepared for the Arizona Corporation Commission

January 2011

Docket No. E-00000D-11-0017

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## **Introduction**

This report updates and replaces the ten year transmission plan of the Salt River Project Agricultural Improvement and Power District (SRP), submitted in January 2010 pursuant to A.R.S. Section 40-360.02. The following general review is intended to complement and clarify the individual tabular pages included herein.

Any future facilities which might have appeared in previous ten year plans, but which are no longer shown in this ten year planning period, are either completed or are no longer scheduled in the period covered. Due to economic conditions over the past several years and the resulting decline in projected customer growth in SRP's service territory, many of SRP's transmission projects continue to be delayed. When customer growth increases, SRP will reassess its projects' in-service dates, as appropriate.

## **Regional Planning Forums**

SRP continues to be involved in numerous regional and sub-regional planning organizations, providing both technical support and leadership. SRP's primary goal in its involvement in these various planning activities is to ensure that a dependable and economical transmission system is connected to energy sources that provide dependable power at reasonable prices to our customers. Participation in the regional and sub-regional planning organizations also allows SRP to better assess its renewable generation options and ensures SRP's transmission plans are coordinated with the plans of the other transmission providers.

The regional and sub-regional planning organizations operate in public forums, develop plans in a collaborative fashion, perform study work cooperatively and disseminate the study results to a broad spectrum of interested and affected parties. The integration of non-dispatchable generation, the location of renewable and traditional resources, and the siting of new transmission corridors continue to be some of the most challenging issues facing SRP, the state of Arizona, and the southwest with respect to meeting electric system reliability. The regional and sub-regional planning organizations are addressing these challenges and SRP relies on the results generated through these organizations to help develop its ten year plan.

SRP is very active in both the Western Electric Coordinating Council (WECC) and WestConnect organizations. WECC's Planning Coordination Committee (PCC) and Transmission Expansion Planning Policy Committee (TEPPC) are important regional planning forums for the Western Interconnection. SRP also participates in the regional transmission planning activities of WestConnect. WestConnect is comprised of 13 utility companies with transmission assets in 8 states in the western United States. WestConnect members collaboratively assess stakeholder needs and develop cost-effective transmission and wholesale market enhancements. WestConnect is committed to coordinating its work with other regional industry efforts to achieve as much consistency as possible in the Western Interconnection. The WestConnect Planning Committee completed and approved its first annual Ten Year Transmission Plan in January 2008. SRP's transmission plans will be included in the February 2011 WestConnect Ten Year Transmission Plan.

The Southwest Area Transmission Planning Group (SWAT), with its technical study subcommittees, work groups and task forces, addresses future transmission needs on a sub-regional (desert southwest) basis. SRP is engaged in various SWAT activities and relies on the following SWAT entities to meet obligations for the Arizona Corporation Commission (ACC) and Ten Year Plan filing: Central Arizona Transmission System (CATS<sup>1</sup>), Colorado River Transmission System (CRT), Southern Arizona Transmission System (SATS), Short Circuit Work Group, Renewable Energy Transmission Task Force, Eldorado Valley Study Group, and the Transmission Corridor Work Group. SWAT disseminates all of its work publically and coordinates its studies and data with other sub-regional planning groups and WestConnect.

## **2010 6<sup>th</sup> BTA Order Requirements**

In November 2010 the ACC issued a decision approving the Sixth Biennial Transmission Assessment (BTA) report that concludes "the Arizona utility industry has implemented steps to address the regional transmission planning issues, provide transmission enhancements and additions, develop solutions for transmission import constraints in various load pockets, support the growth of renewable resources in Arizona, and address local transmission system inadequacies." In addition to the approval of the report, the ACC decision adopted several new

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<sup>1</sup>In November 2009, the CATS-HV and CATS-EHV Committees merged and was named "CATS", Central Arizona Transmission System, although the scope of the group's studies reach beyond central Arizona.

requirements that apply to only the jurisdictional utilities; however, SRP has agreed to voluntarily comply with the new requirements. The new requirements are:

1. Jurisdictional utilities shall report relevant findings in future BTAs regarding compliance with transmission planning standards (e.g., TPL-001 through TPL-004) from NERC/WECC reliability audits that have been finalized and filed with FERC.
2. Jurisdictional utilities shall include planned transmission reconductor projects, transformer capacity upgrade projects and reactive power compensation facility additions at 115 kV and above in future BTA ten year plan filings.
3. Jurisdictional utilities shall jointly conduct or procure a study, as well as conduct a stakeholder workshop process in conjunction with the study, which identifies the barriers to and solutions for enhancing Arizona's ability to export renewable energy, including identifying specific transmission corridors that should be built out in order to accomplish this objective. The study and results of the workshop shall be filed at the ACC no later than November 1, 2011 and shall be included as part of the 2012 BTA.
4. Jurisdictional utilities shall include the effects of distributed renewable generation and energy efficiency programs on future transmission needs in future ten year plan filings, beginning in January 2011, and a discussion of these effects will take place in future BTAs.

SRP's voluntary compliance response to the new requirements is:

**Requirement 1:**

SRP will report relevant NERC audit findings in future BTAs once the findings are finalized and filed with the Federal Energy Regulatory Commission (FERC).

**Requirement 2:**

SRP's planned transmission reconductor, transformer capacity upgrades, and reactive power compensation additions in this ten year period are shown below and are being provided for informational purposes only as these projects do not require siting approval.

*Reactive Devices*

SRP currently anticipates the addition of a 500kV reactor as part of the Southeast Valley Project<sup>2</sup>. SRP anticipates this reactor will be located at the Pinal Central Substation, and the reactor size is currently estimated to be 170 MVA.

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<sup>2</sup> The Pinal West – Pinal Central – Abel – Browning project is commonly referred to as the Southeast Valley project.

*Reconductor*

Currently, there are no reconductor projects planned during this timeframe.

*Transformers*

The following are the currently planned transformer additions, including the anticipated installation schedule, during this timeframe.

- 3<sup>rd</sup> Kyrene 500/230kV (2012)
- Pinal Central (2) 500/230kV (2014)
- Abel 230/69kV (2011)
- Rudd 230/69kV (2013)
- Schrader 230/69kV (2014)

SRP and project participants are evaluating the need and timing of phase shifting transformers (PSTs) for the Southeast Valley and Desert Basin-Pinal Central projects.

Inasmuch as presently there are no definitive plans for the PSTs, SRP cannot provide more specific information in this ten year transmission plan.

**Requirement 3:**

SRP intends to participate in the study and workshops to identify solutions for enhancing Arizona's ability to export renewable energy.

**Requirement 4:**

SRP already includes the effects of energy efficiency programs and distributed generation (traditional and renewable) in its resource planning and transmission system models. While these programs do reduce energy consumption and load, there remains a need for new transmission to meet peak load requirements, as indicated in this year's ten year transmission plan filing.

**500kV Transmission**

The SRP 500kV transmission system is shown in Figure 1 – SRP 500kV system (see Project Maps section). This system provides major support to SRP's local transmission network and generally delivers bulk power from remote generation to the Phoenix Valley.

***Hassayampa – Pinal West***

In May 2004, SRP, acting as project manager for itself and co-owners Arizona Public Service<sup>3</sup>, Tucson Electric Power Company, Southwest Transmission Cooperative, Electric District 2, Electric District 3, and Electric District 4 of Pinal County, received a CEC (Case No. 124) for two parallel single circuit 500kV transmission lines from the Palo Verde hub (Hassayampa Switchyard) to a new Pinal West Substation in the Maricopa/Stanfield area. Determination of the centerline within the approved corridor for both of the lines was completed in 2007. The first line to Pinal West was energized in October of 2008. The second line is currently beyond the ten year planning timeframe; the timing of the second line will be dependent on load growth, the need to access new resources and location of future generation. The CEC for this project expires on May 24, 2024.

***Pinal West – Pinal Central – Abel – Browning***

In August 2005, SRP received a CEC for this joint participation project (Case No. 126), also commonly referred to as the Southeast Valley Project. The CEC for this project expires in August 2025. Project participants include SRP, Tucson Electric Power Company, Electric District 2, Electric District 3, and Electric District 4 of Pinal County. This 500kV project begins at the Pinal West Substation and ends at the existing Browning Substation with intermediate interconnections at the Santa Rosa, the proposed Pinal Central (formerly known as Pinal South), and the proposed Abel (formerly known as RS22/Southeast Valley) Substation. The completion dates for the individual substations and the various segments of the 500kV and 230kV circuits are discussed below.

***Pinal West – Pinal Central Segment***

The Pinal Central Substation was sited during the proceedings for the Pinal West to Browning 500kV line. The station is envisioned as a terminal for 500kV and 230kV transmission lines to bolster the EHV system in Pinal County and provide for delivery of power and energy to the Local Load Serving Entities (LLSE's). In the past few years, a number of entities have expressed interest in interconnecting to the 230kV and 500kV yards of this substation. The estimated in-service date for the Pinal Central Substation is 2014.

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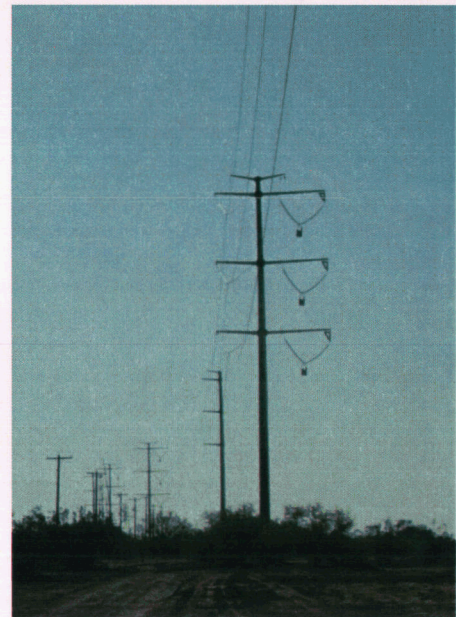
<sup>3</sup> Arizona Public Service withdrew from participation in the project on September 15, 2005.

The segment of the line from Pinal West to Pinal Central includes an intermediate interconnection at the proposed 500kV Santa Rosa Substation. The Santa Rosa 500kV Substation has an anticipated 2015 in-service date.

The segment from Pinal West to Santa Rosa is planned as a single circuit 500kV line and the segment from Santa Rosa to Pinal Central is planned as a double circuit 500/230kV line. The estimated in-service date for the Pinal West to Pinal Central segment of the 500kV line is 2014.

### **Pinal Central – Browning Segment**

The segment from Pinal Central to the Browning Substation is planned as a double circuit 500/230kV line and the majority of this segment is expected to be in-service in 2011. The section from Browning to Randolph (a switchyard located between Abel and Pinal Central to export power from the TransCanada Coolidge Generating Station) was placed in-service in 2010. The 500kV component of this line is initially energized at 230kV to provide redundant paths for the TransCanada Coolidge Generating Station. This portion of the line will be converted to 500kV when the overall segment from Pinal Central – Browning is completed in 2014. SRP has entered into a purchase power agreement to take the full output of the TransCanada Coolidge Generating Station. In addition to supporting the Coolidge output, the segment will allow access to other new generating resources that may be developed in the area and that may be available to SRP customers. The 230kV portion of the double circuit 500/230kV transmission line from Dinosaur Substation to the existing Browning Substation in the Southeast Valley was completed in 2007 along with the Dinosaur Substation. The poles to accommodate the 500kV circuit were installed in 2007 as part of the 230kV construction. The Dinosaur-Browning 230kV segment is the parallel circuit of the Pinal Central-Abel-Browning 500kV circuit construction.



*Preparation for pulling 500kV conductor on the double circuit 500/230kV Browning-Pinal Central line in 2009.*

The Abel 500kV Substation, between the Pinal Central and Browning Substations, currently has an in-service date beyond this plan. The purpose of the Abel Substation is twofold: it will provide interconnections into the EHV system to bring generation resources into the SRP service territory and it will provide service to native SRP load. The Abel Substation also includes a co-location of a proposed 230/69kV substation, with an expected in-service date of 2011.

### ***Morgan – Pinnacle Peak***

SRP is a co-owner in the new 500kV line from the Morgan (formerly TS9) Substation (constructed in the vicinity of the Raceway Substation) to the 500kV station at Pinnacle Peak. SRP is not participating in the 230kV component of this project. APS is the project manager and received a CEC for this project in February 2007 (Case No. 131). This line was energized in November 2010.

### ***Palo Verde – Delany – Sun Valley, Sun Valley – Morgan***

SRP is participating in the siting and permitting work and intends to be a co-owner in two new 500kV lines. The first line is from the Palo Verde Nuclear Generating Station to a new 500kV station, Delany, and then into the new

Sun Valley 500/230kV station. Sun Valley will be located on the south side of the Central Arizona Project near the Hassayampa Pump Station (approximately T4N, R4W). APS received a CEC (Case No. 128) for this segment of the project in August 2005. The second line will originate from Sun Valley and terminate at the existing Morgan 500kV Station. APS, as project manager, received a CEC (Case No. 138) for this second line in March 2009. This project is reflected in two separate project description sheets: Palo Verde – Delany – Sun Valley and Sun Valley – Morgan. The parties expect that the Palo Verde – Sun Valley line will be in-service in 2014 with the initial Palo Verde – Delany portion in-service by 2013. The Sun Valley – Morgan line will be completed



*Stringing the Morgan -Pinnacle Peak line using a helicopter in 2010.*

by 2016. The CECs for these projects expire in 2015 (Sun Valley – Delany), 2016 (Sun Valley – Morgan), and 2025 (Palo Verde – Delany).

### ***Pinal Central – Tortolita***

Tucson Electric Power Company (TEP) is planning a 500kV transmission line to connect the Hassayampa – Pinal West – Pinal Central transmission lines and the Pinal Central Substation, which TEP owns in part, to TEP's existing Tortolita Substation located in northern Pima County. This new line will reinforce the EHV system and provide a higher capacity link for the flow of power from the Palo Verde area into northern Pima County. TEP is the project manager and SRP is participating in the project for access to possible resource additions, including renewable resources. TEP expects to file for a CEC in 2011. The parties expect that the Tortolita – Pinal Central line will be in service in 2014.

### ***Palo Verde – North Gila #2***

SRP participated in the siting and permitting and intends to be a co-owner in the new 500kV line from the Palo Verde/Hassayampa Switchyard to the North Gila 500/69kV Substation. This new line will provide SRP with access to geothermal resources in the Imperial Valley area of California as well as potential future renewable development along the I-8 Corridor. APS is the project manager and received a CEC for this project from the ACC in January 2008 (Case No. 135). The CEC for Palo Verde – North Gila #2 expires in 2015. The estimated in-service date for this line is 2014.

### ***SunZia Southwest Transmission Project***

Southwestern Power Group is the project manager for the SunZia project. SunZia is a proposed 500kV system (two lines) from the central part of New Mexico to central Arizona. The SunZia participants are considering Pinal Central as one of the terminations for connecting to the central Arizona transmission system. SRP's participation in this transmission line will provide SRP access to anticipated renewable generation resources in southeastern Arizona and New Mexico.

Southwestern Power Group has initiated the federal permitting process in compliance with NEPA (National Environmental Policy Act) procedures. The project currently is scheduled for an in-service date of 2015/2016.

## **230kV Transmission**

The SRP 230kV transmission system is shown on Figure 2 – SRP 230kV system overview and in greater detail on Figure 3 – Detail of SRP's 230kV West System and Figure 4 – Detail of SRP's 230kV East System (see Project Maps section). SRP's 230kV transmission network is used to transmit power from the bulk 500kV power stations on the periphery of the Phoenix metropolitan area to the various load centers in SRP's service territory. Additional transmission capacity will be required during the next ten years to meet load growth and for system reliability.

### ***Abel – Pfister (RS24) – Ball (Moody/RS17)***

This project was formerly known as Abel-Moody. Study work based on load projections for the Southeast Valley indicates the need to provide additional transformer capacity to meet residential, commercial, and industrial loads. The Pfister (formerly RS24) Substation, to be located in the Queen Creek area, and the double-circuit transmission lines connecting the substation to the system, will provide the additional necessary capacity. This project is expected to be in-service by 2019. SRP filed its CEC application in June 2009 (Case No. 148) and received approval from the ACC on December 23, 2009. The CEC for this project expires December 23, 2021.

### ***Desert Basin Power Line Project (Desert Basin – Pinal Central)***

SRP was awarded a CEC (Case No. 132) for the construction of this 230kV line in June 2007 in ACC Decision No. 69647. This project consists of two components. The first component is approximately six miles of new 230kV transmission line originating at the Desert Basin Generating Station in Casa Grande and terminating at the junction of Thornton Road and Cornman Road where it will intersect with the already-certificated Pinal West – Abel/Browning 500/230kV Project (Case 126, Decision No. 68093). The second component of the project will utilize the 500/230kV Pinal West – Abel/Browning route, where SRP will attach the 230kV circuit to the 500kV structures for approximately 15 miles to the Pinal Central Substation south of Coolidge. SRP received approval for the addition of the 230kV component to the 500kV structures in Decision No. 69183 (Condition No. 23 in Case No. 126). This project is expected to be constructed in conjunction with the Pinal West to Pinal Central segment of the 500kV Project. The expected in-service date is 2014. The CEC for this project expires June 6, 2025.

***Santa Rosa – Pinal Central – Abel – Dinosaur – Browning***

The ACC granted SRP authority to construct an optional 230kV circuit on the 500kV structures between the Santa Rosa and Abel Substations, conditioned upon SRP providing appropriate study work to the ACC to support the need for the 230kV circuit. SRP, in two separate submittals to the ACC dated August 11, 2006 and June 27, 2008, provided the necessary study work to support the need for the 230kV circuit from Santa Rosa Substation to the Abel Substation. The ACC approved SRP's need for the 230kV circuit in Case No. 126, Decision Numbers 69183 (December 8, 2006) and 70610 (November 19, 2008). The CEC expires August 25, 2025.

The segment of the line from Abel Substation to Dinosaur Substation to the Browning Substation was certificated for a double circuit 500/230kV transmission line and did not require additional study work. The Dinosaur-Browning section was energized in 2007. The Pinal Central – Abel – Dinosaur 230kV segment of the Southeast Valley Project will be utilized to connect the TransCanada Coolidge Generating Station to SRP's load service territory. The in-service dates for the individual segments are as follows:

- Pinal Central – Abel
  - Pinal Central – Randolph (2014)
  - Randolph – Abel (2011)
- Abel – Dinosaur (2011)
- Dinosaur – Browning (In-service 2007)

**Eastern Mining Area (EMA) Transmission**

Additional transmission facilities eventually may be required in SRP's Eastern Mining Area (Figure 5 - SRP's Eastern Mining Area, see Project Maps section). If mining loads increase between Superior and Hayden, a 230kV line from Silver King to New Hayden may be required. Depending on where new load is added, this 230kV line may have an intermediate termination at Knoll Station. The line may be constructed in phases, with the Silver King to Knoll line being constructed first, followed by the Knoll to New Hayden line, when required. The existing 115kV line from Kearny to Hayden may be looped into the New Hayden Station. The in-service dates for these lines are contingent upon customer need, but are currently projected beyond this ten year plan.

SRP is currently working with Resolution Copper to develop 230kV or 500kV transmission options to serve a potential new copper mine in SRP's EMA. SRP and Resolution are currently studying a number of transmission options to serve the mining and milling operations. A definitive scope and schedule is not available at this time, but it is currently anticipated that project completion would occur during this ten year planning period.

## **Potential Future Projects**

A key element of SRP's transmission planning function is to utilize existing transmission corridors and open circuit positions on existing transmission structures, where feasible. When not feasible, new corridors are explored. These potential projects are included in the project description sheets with dates shown as "to be determined". When system conditions warrant these facilities, more definitive descriptions and schedules will be provided. Some of these projects could advance into the ten year reporting period as system conditions change.

## **Re-named Projects**

SRP re-named projects this year to help clarify the projects planned for the ten year timeframe.

- RS20–Silver King–Coronado 500kV (now Northeast Arizona–Phoenix Transmission)
- Rogers–Browning 230kV (now Rogers–Santan)
- Thunderstone–Santan (now Thunderstone–Browning)
- Rogers–Corbell (now Browning–Corbell)

## **Receiving Station Names**

SRP identifies future high voltage stations as "RS" stations. The "RS" stands for receiving station and this designation is utilized until a formal name is assigned. In this and other documents the following stations may have been identified as an RS station. The following information is provided to identify the receiving station names by their formal names. Not all RS stations have been formally named so there are gaps in the numbering below:

RS-16 = Schrader

RS-17 = Ball

RS-18 = Browning

RS-19 = Dinosaur

RS-22 = Abel (formerly Southeast Valley, SEV)

RS-24 = Pfister

## **SRP Ten Year Plan Study Work**

Attachment 1 with this filing is a study that analyzed the impact of the projects identified in the Ten Year Plan. Study work for joint projects relies on sub-regional and previously submitted studies.

### **Project Maps**

The following pages are maps showing the location of existing and future transmission projects. Separate maps are provided for the 500kV system, an overview of the 230kV system and then a larger view of the 230kV system broken down into west and east views. The 115kV map primarily covers the 115kV Eastern Mining Area of SRP's service territory, however some 230kV projects are included as well.

The maps included in this report are:

- Figure 1 - SRP 500kV system
- Figure 2 - SRP 230kV system overview
- Figure 3 - Detail of SRP's 230kV west system
- Figure 4 - Detail of SRP's 230kV east system
- Figure 5 - SRP's 115kV Eastern Mining Area

# SRP's 500kV System

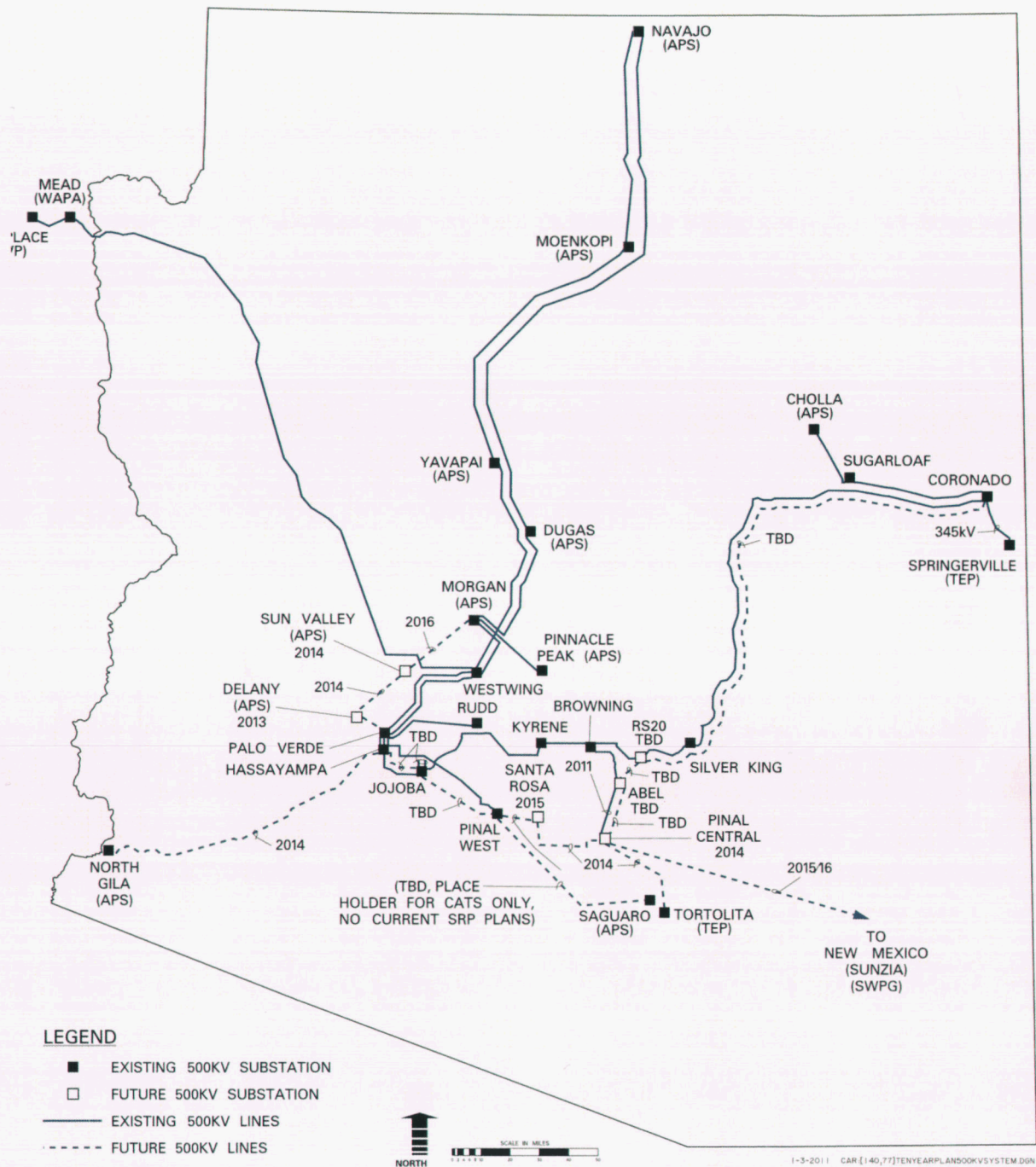
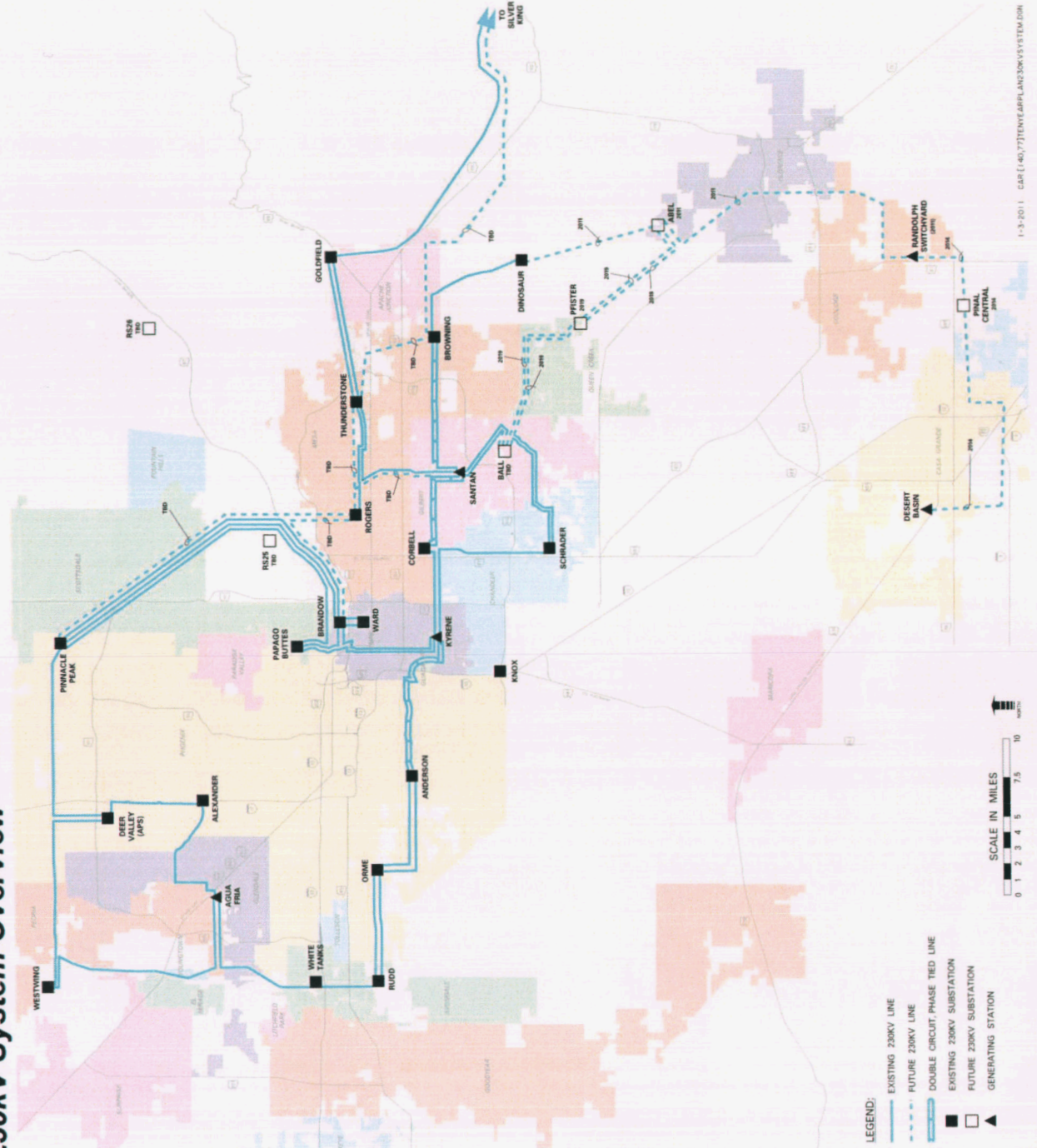


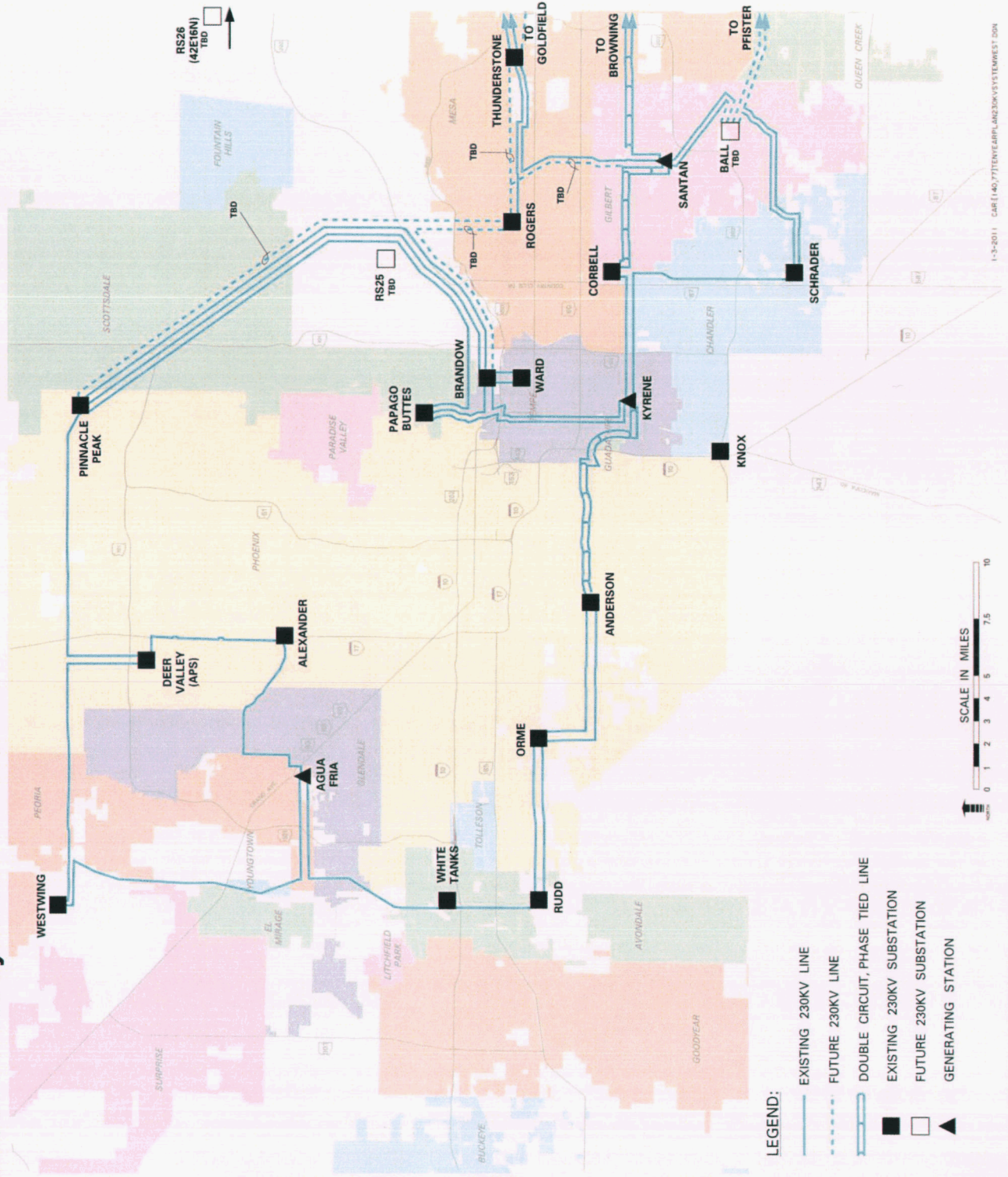
Figure 1 - SRP 500kV system

## SRP's 230kV System Overview



## Figure 2 - SRP 230kV System Overview

# SRP's 230kV West System



# SRP's 230kV East System

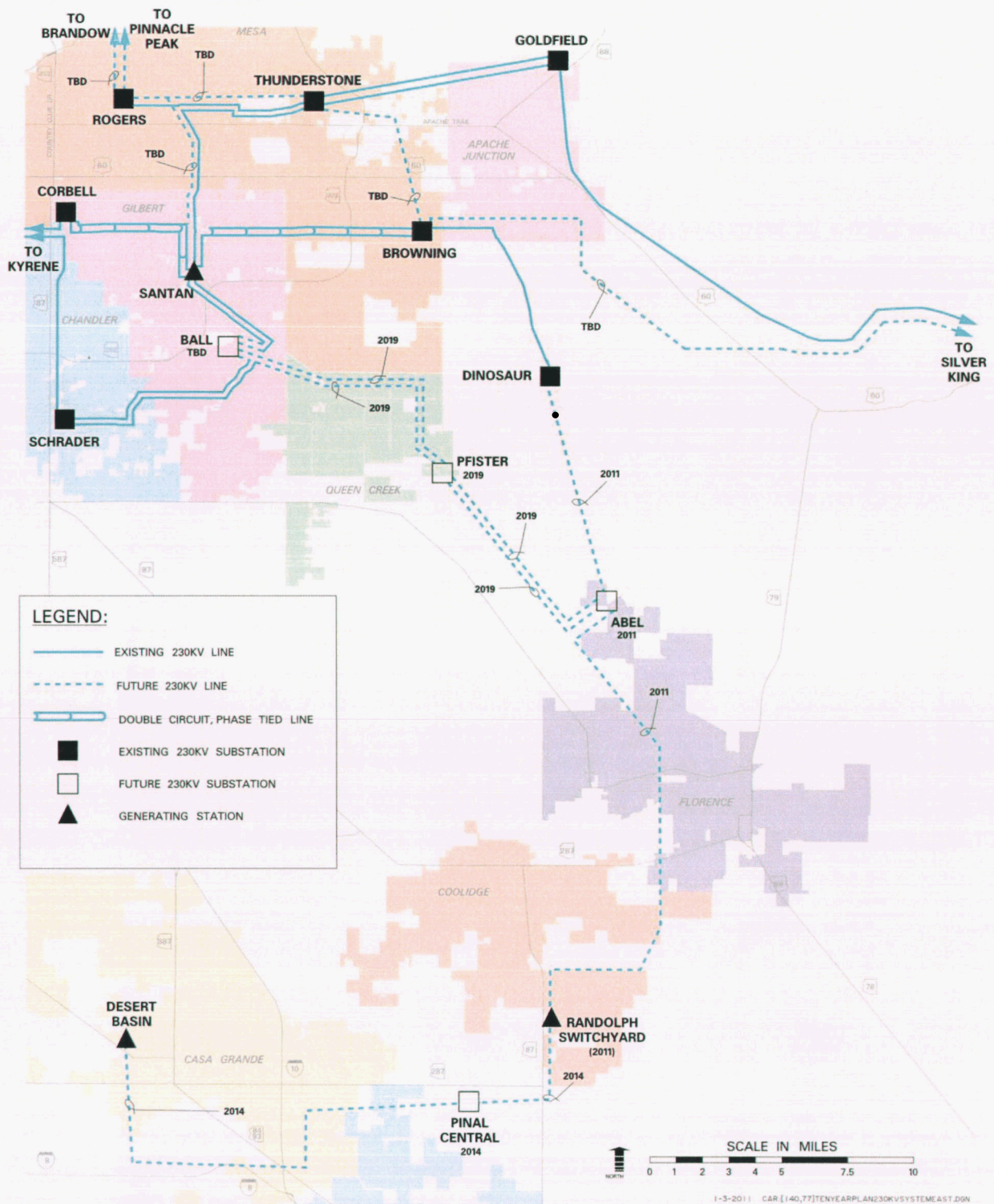


Figure 4 - Detail of SRP's 230kV East System

**SRP's 115kV System (Eastern Mining Area)**



Figure 5 - SRP's Eastern Mining Area

## **Project Descriptions**

The following pages provide project detail, meeting the requirements of A.R.S. Section 40-360.02. Each project is identified by name, estimated in-service date, sizing details, routing, purpose, and major milestone dates.

### ***2011-2020 Projects***

The following projects are anticipated in the 2011-2020 timeframe.

- Pinal West – Pinal Central – Abel – Browning 500 & 230kV line (2011-2015)
- Palo Verde – Delany – Sun Valley 500kV line (2013-2014)
- Pinal Central – Tortolita 500kV line (2014)
- Palo Verde – North Gila #2 500kV line (2014)
- SunZia Southwest Transmission 500kV Project (2015/2016)
- Sun Valley – Morgan 500kV line (2016)
- Desert Basin – Pinal Central 230kV (2014)
- Abel – Pfister – Ball 230kV (2019)

### ***Potential Future Projects***

The following projects are outside the ten year plan window, but are provided for informational purposes.

- Pinal Central – Abel – RS20 500kV line (TBD)
- Hassayampa – Pinal West 500kV #2 (TBD)
- Northeast Arizona to Phoenix 500kV line (TBD)
- Palo Verde – Saguaro 500kV line (TBD)
- Ball (RS17) 230kV Loop-in (TBD)
- Rogers – Santan 230kV line (TBD)
- Silver King – Browning 230kV line (TBD)
- Superior 230kV Loop-in (TBD)
- Thunderstone – Browning 230kV line (TBD)
- Pinnacle Peak – Brandow 230kV (TBD)
- Browning – Corbell 230kV line (TBD)
- Silver King – Knoll – New Hayden 230kV (TBD)
- New Hayden 115kV Station Loop-in (TBD)
- RS25 Project (TBD)
- RS26 Project (TBD)

***Pinal West – Pinal Central – Abel – Browning 500 & 230kV line (2011-2015)***

<b><i>Size</i></b>	
<i>Voltage</i>	500 & 230kV
<i>Capacity</i>	Approximately 1500 MVA
<i>Point of Origin</i>	Pinal West Substation SEC 18, T5S, R2E
<i>Intermediate point</i>	Santa Rosa Substation SEC 30, T5S, R4E
<i>Intermediate point</i>	Pinal Central Substation SEC 30, T6S, R8E
<i>Intermediate point</i>	Randolph Switchyard SEC 10, T6S, R8E
<i>Intermediate point</i>	Abel Substation SEC 19, T3S, R9E
<i>Intermediate point</i>	Dinosaur Substation SEC 10, T2S, R8E
<i>Point of Termination</i>	Browning Substation SEC 12, T1S, R7E
<i>Length</i>	Approximately 100 Miles

***Routing***

South and east from the Pinal West Substation to approximately Teel Road, then east to the vicinity of the Santa Rosa Substation. From Santa Rosa easterly to approximately the Santa Rosa Wash, then generally south to approximately a half mile north of I-8 where it turns east again. Then it runs easterly to about the location of the Pinal Central Substation (near the ED2 substation). From that point the line continues east to the Union Pacific Railroad, where it turns north. It generally runs north from this point to the Abel Substation in the vicinity of the Magma Railroad and the CAP (approximate location of the Abel Substation), then north along the CAP to the existing 500kV corridor between Elliot and Guadalupe Roads. At that point it turns west into the Browning Substation.

## ***Pinal West – Pinal Central – Abel – Browning 500 & 230kV line (2011-2015) continued***

### ***Purpose***

The Central Arizona Transmission System Study identified a number of system additions necessary to accommodate load growth and access to energy sources in the central Arizona area. This transmission line is the second segment of a series of transmission lines to serve the central Arizona region. This segment will initially provide an interconnection with the Palo Verde market area to market power to the Phoenix and central Arizona areas, and to accommodate the growth in development and population in Pinal County.

### ***Schedule***

<i>Right of Way/ Property Acquisition</i>	2005
<i>Construction Start</i>	2006
<i>Estimated In-Service</i>	2011 – Randolph – Abel – Dinosaur 230kV 2011 – Abel 230kV Substation 2014 – Pinal Central – Randolph 230kV 2014 – Pinal Central – Browning 500kV (the voltage and configuration change of the 2010 Randolph-Browning 230kV section). 2014 – Pinal West – Pinal Central 500kV and 230kV 2014 – Pinal Central 500kV and 230kV Substation 2015 – Santa Rosa 500kV Substation 2020 – Abel 500kV Substation
<i>Actual In-Service</i>	2007 – Dinosaur Substation 2007 – Dinosaur – Browning 230kV 2010 – Randolph – Browning 500kV energized at 230kV

### ***Notes***

The authorization for this line is provided for in the CEC for Case No. 126 (Pinal West to Browning), which was awarded in 2005 (ACC Decision # 68093 and # 68291). SRP was awarded ACC Decisions # 69183 and 70610 that allow for the attachment of the 230kV line to the previously approved 500kV structures. The CEC for the project expires August 25, 2025.

SRP is the project manager for the development of this project. Participants include SRP, Tucson Electric Power, and Electric Districts 2, 3 and 4 of Pinal County.

***Palo Verde – Delany – Sun Valley 500kV line (2013-2014)******Size***

<i>Voltage</i>	500kV
<i>Capacity</i>	To be determined
<i>Point of Origin</i>	Palo Verde Switchyard or a new switchyard at Arlington Valley Energy facility
<i>Intermediate point</i>	Proposed Delany Switchyard Approximately SEC 25, T2N, R8W
<i>Point of Termination</i>	Future Sun Valley 500/230kV Substation SEC 29, T4N, R4W
<i>Length</i>	Approximately 45 miles of single-circuit line

***Routing***

Generally west from Palo Verde/Hassayampa to the proposed Delany Switchyard and then north and east to the Sun Valley Substation.

***Purpose***

This line will provide a 500kV interconnection to the APS transmission system and serve projected need for electric energy in the area immediately north and west of the Phoenix Metropolitan area. The project will increase the import capability into the valley and the export capability out of the Palo Verde/Hassayampa area.

***Schedule***

<i>Right of Way/ Property Acquisition</i>	2005
<i>Construction Start</i>	2011
<i>Estimated In-Service</i>	2013 – Delany Switchyard
	2013 – Palo Verde – Delany
	2014 – Delany – Sun Valley

***Notes***

APS is the project manager on the development of this project. SRP was a participant in the environmental siting work and anticipates being a co-owner.

APS received a CEC in Case No. 128 (Decision # 68063) in August 2005. The segment of the line from the Palo Verde Hub to Harquahala Junction Switchyard (Delany) expires on August 17, 2025 (20 year CEC) while the segment from Delany to Sun Valley expires August 17, 2015 (10 year CEC).

***Pinal Central – Tortolita 500kV line (2014)******Size***

<i>Voltage</i>	500kV
<i>Capacity</i>	To be determined
<i>Point of Origin</i>	Pinal Central Substation SEC 30, T6S, R8E
<i>Intermediate point</i>	None
<i>Point of Termination</i>	Tortolita Substation SEC 14, T10S, R10E
<i>Length</i>	To be determined through the siting process

***Routing***

Subject to completion of the siting process. Generally south from the Pinal Central Substation to the Tortolita Substation.

***Purpose***

This line will provide SRP access to possible resources in Pima and Pinal Counties.

***Schedule***

<i>Right of Way/ Property Acquisition</i>	To be determined
<i>Construction Start</i>	To be determined
<i>Estimated In-Service</i>	2014

***Notes***

Tucson Electric Power is the project manager and plans to file for a CEC for this project in 2011. SRP is a participant in the siting of the transmission line and anticipates being a co-owner.

**Palo Verde – North Gila #2 500kV line (2014)****Size**

<i>Voltage</i>	500kV
<i>Capacity</i>	Approximately 1200MVA
<i>Point of Origin</i>	Hassayampa Switchyard, Arlington Valley Power Plant or Redhawk Power Plant
<i>Intermediate point</i>	None
<i>Point of Termination</i>	North Gila 500/69kV Substation SEC 11, T8S, R22W
<i>Length</i>	Approximately 115 miles of single-circuit line

**Routing**

Generally follows the existing Hassayampa - North Gila 500kV #1 line.

**Purpose**

This line will provide SRP access to potential renewable resources.

**Schedule**

<i>Right of Way/ Property Acquisition</i>	To be determined
<i>Construction Start</i>	To be determined
<i>Estimated In-Service</i>	2014

**Notes**

APS is the project manager. SRP was a participant in the siting and permitting effort and anticipates being a co-owner in the project. The CEC for Case No. 135 was awarded in January 2008 (Decision # 70127). The CEC expires January 23, 2015.

***SunZia Southwest Transmission 500kV Project (2015/2016)******Size***

<i>Voltage</i>	500kV
<i>Capacity</i>	Approximately 3000MVA
<i>Point of Origin</i>	Central New Mexico
<i>Intermediate point</i>	To be determined
<i>Point of Termination</i>	Pinal Central Substation SEC 30, T6S, R8E
<i>Length</i>	460+ miles

***Routing***

From Lincoln County area in central New Mexico to Pinal Central Substation in Coolidge, Arizona.

***Purpose***

Provide SRP access to anticipated renewable generation resources in southeastern Arizona and New Mexico.

***Schedule***

<i>Right of Way/ Property Acquisition</i>	To be determined
<i>Construction Start</i>	To be determined
<i>Estimated In-Service</i>	2015/2016

***Notes***

Southwestern Power Group is the project manager on the development of this project. SRP is a participant.

**Sun Valley – Morgan 500kV line (2016)****Size**

<i>Voltage</i>	500kV
<i>Capacity</i>	To be determined
<i>Point of Origin</i>	Sun Valley (formerly TS5) 500/230kV Substation SEC 29, T4N, R4W
<i>Intermediate point</i>	none
<i>Point of Termination</i>	Morgan (formerly TS9) 500kV Substation SEC 33, T6N, R1E
<i>Length</i>	Approximately 40 miles

**Routing**

Generally the line will exit the Sun Valley Substation and head north-northeast and then east to the Morgan Substation.

**Purpose**

This line will be needed to serve projected electric energy load in the area immediately north and west of the Phoenix Metropolitan area, and will increase the import capability into the Valley.

**Schedule**

<i>Right of Way/ Property Acquisition</i>	To be determined
<i>Construction Start</i>	2013
<i>Estimated In-Service</i>	2016

**Notes**

APS is the project manager. SRP was a participant in the siting and permitting effort and anticipates being a co-owner in the project. APS was awarded a CEC in Case No. 138 (Decision # 70850) in March 2009. The CEC expires March 17, 2016 for the 500kV circuit.

**Desert Basin – Pinal Central 230kV (2014)****Size**

<i>Voltage</i>	230kV
<i>Capacity</i>	Approximately 630MVA
<i>Point of Origin</i>	Desert Basin Power Plant Switchyard SEC 13, T6S, R5E
<i>Intermediate point</i>	None
<i>Point of Termination</i>	Pinal Central 230kV Substation SEC 30, T6S, R8E
<i>Length</i>	Approximately 21 miles

**Routing**

For approximately 6 miles from the Desert Basin Generating Station in Casa Grande near Burris and Kortsen Roads generally south and east to a point on the certificated SEV 500kV line near Cornman and Thornton Roads. At that point the 230kV line will be attached to the 500kV structures for approximately 15 miles to the proposed Pinal Central Substation south of Coolidge, AZ.

**Purpose**

Remove the Remedial Action Scheme that was previously installed on Desert Basin Generating Station; improve reliability of the 230kV system in the region by reducing the loading on existing lines in the area; increase local area system capacity; reduce reliance on second party transmission system; create the first 230kV component of the CATS-HV proposed transmission system for the central Arizona area; and establish the Pinal Central Substation, identified as one of the future injection points of power and energy into the expanding central Pinal County load area, which will help local utilities serve local load.

**Schedule**

<i>Right of Way/ Property Acquisition</i>	2010
<i>Construction Start</i>	2013
<i>Estimated In-Service</i>	2014

**Notes**

SRP was granted a CEC for Case No. 132 in June 2007 (ACC Decision # 69647, CEC expires June 6, 2025) for the approximately six mile portion of the project from Desert Basin Generating Station to the vicinity of Cornman and Thornton Roads south of Casa Grande. Authority for the portion of the 230kV line to be attached to the 500kV structures is provided for in Decision # 69183, which approved SRP's compliance filing for Condition 23 of the CEC for Case No 126.

**Abel – Pfister – Ball 230kV (2019)****Size**

<i>Voltage</i>	230kV
<i>Capacity</i>	Approximately 875 MVA
<i>Point of Origin</i>	Future Ball (RS17) Substation SEC 1, T2S, R6E
<i>Intermediate point</i>	Future Pfister (RS24) Substation SEC 25, T2S, R7E
<i>Point of Termination</i>	Abel Substation SEC 19, T3S, R9E
<i>Length</i>	Approximately 20 miles

**Routing**

Generally south and east from a point on the Santan to Schrader 230kV line near the future Ball (RS17) Substation to the Pfister (RS24) Substation in the south and east of the Queen Creek area, continuing south and east to the future Abel Substation.

**Purpose**

To meet expected load growth in the eastern service territory.

**Schedule**

<i>Right of Way/ Property Acquisition</i>	2011
<i>Construction Start</i>	2017
<i>Estimated In-Service</i>	2019

**Notes**

This project was formerly known as Abel-Moody. SRP received a CEC for this project on December 23, 2009, Case No. 148, Decision # 71441. The CEC expires December 23, 2021.

This project is a double circuit 230kV line.

***Pinal Central – Abel – RS20 500kV line (TBD)******Size***

<i>Voltage</i>	500kV
<i>Capacity</i>	To be determined
<i>Point of Origin</i>	Pinal Central Substation SEC 30, T6S, R8E
<i>Intermediate point</i>	Abel Substation SEC 19, T3S, R9E
<i>Point of Termination</i>	Future RS20 Substation SEC 5 or 6, T2S, R10E
<i>Length</i>	Approximately 45 miles

***Routing***

Generally north from the Pinal Central Substation to Abel, then north and east from Abel to the future RS20 Substation as yet to be sited.

***Purpose***

This line is required for delivery of remote resources into the southeast portion of SRP's service territory.

***Schedule***

<i>Right of Way/ Property Acquisition</i>	To be determined
<i>Construction Start</i>	To be determined
<i>Estimated In-Service</i>	Pinal Central – Abel 2 <sup>nd</sup> circuit – To be determined Abel – RS20 – To be determined

***Notes***

SRP does not hold a CEC for this project, but will be seeking a Certificate subsequent to an environmental and public process to site the line.

**Hassayampa – Pinal West 500kV #2 (TBD)****Size**

<i>Voltage</i>	500kV
<i>Capacity</i>	Approximately 1500 MVA
<i>Point of Origin</i>	Hassayampa Switchyard SEC 15, T1S, R6W
<i>Intermediate point</i>	None
<i>Point of Termination</i>	Pinal West Substation SEC 18, T5S, R2E
<i>Length</i>	Approximately 51 miles

**Routing**

South and east of the Hassayampa Switchyard along the existing Palo Verde–Kyrene 500kV line to a point where the gas pipeline splits from the transmission line, then generally along the pipeline (except in the Maricopa County Mobile Planning Area) to the Pinal West Substation.

**Purpose**

The Central Arizona Transmission System Study identified a number of system additions necessary to accommodate load growth and access to energy sources in the central Arizona area. This project is one of the first segments of a series of transmission lines to serve the central Arizona region.

**Schedule**

<i>Right of Way/ Property Acquisition</i>	2004
<i>Construction Start</i>	To be determined
<i>Estimated In-Service</i>	To be determined

**Notes**

The CEC for Case No. 124 was awarded in May 2004 (ACC Decision # 67012). The CEC expires May 24, 2024. SRP is project manager for development of this project. Co-owners include SRP, Tucson Electric Power, Southwest Transmission Cooperative, and Electric Districts 2, 3, and 4 of Pinal County. The first of the two permitted transmission lines was placed in service in October 2008.

**Northeast Arizona to Phoenix 500kV line (TBD)****Size**

<i>Voltage</i>	500kV
<i>Capacity</i>	To be determined
<i>Point of Origin</i>	Northeast Arizona
<i>Intermediate point</i>	None
<i>Point of Termination</i>	Eastern metro Phoenix
<i>Length</i>	Approximately 200 miles

**Routing**

The routing for this line is to be determined.

**Purpose**

This line would facilitate delivery of resources from Northeast Arizona into eastern metropolitan Phoenix.

**Schedule**

<i>Right of Way/ Property Acquisition</i>	To be determined
<i>Construction Start</i>	To be determined
<i>Estimated In-Service</i>	To be determined

**Notes**

SRP does not hold a CEC for this project, but will be seeking a Certificate subsequent to an environmental and public process to site the line.

***Palo Verde – Saguaro 500kV line (TBD)******Size***

<i>Voltage</i>	500kV
<i>Capacity</i>	To be determined
<i>Point of Origin</i>	Palo Verde Generating Switchyard / Hassayampa Switchyard SEC 34, T1N, R6W
<i>Intermediate point</i>	Pinal West Substation SEC 18, T5S, R2E
<i>Point of Termination</i>	Saguaro Substation SEC 14, T10S, R10E
<i>Length</i>	Approximately 125 miles

***Routing***

Generally south and east from the Palo Verde area to a point near Gillespie Dam, then generally easterly until the point at which the Palo Verde – Kyrene 500kV line diverges to the north and east. The corridor then is generally south and east again adjacent to a gas line corridor until meeting up with the Tucson Electric Power Company's West Wing – South 345kV line. The corridor follows the 345kV line until a point due west of the Saguaro Generating Station. The corridor then follows a lower voltage line into the 500kV yard just south and east of the Saguaro Generating Station.

***Purpose***

The line will be needed to increase the adequacy of the existing EHV transmission system and permit increased power delivery throughout the state.

***Schedule***

<i>Right of Way/ Property Acquisition</i>	To be determined
<i>Construction Start</i>	To be determined
<i>Estimated In-Service</i>	To be determined

***Notes***

A CEC was applied for and granted in March 1976 for this line (Case No. 24, ACC Decision # 46802). The CEC is held by APS, SRP, El Paso Electric, Public Service of New Mexico, and Arizona Electric Power Cooperative. This CEC has no expiration date.

**Ball (RS17) 230kV Loop-in (TBD)****Size**

<i>Voltage</i>	230kV
<i>Capacity</i>	Approximately 875 MVA
<i>Point of Origin</i>	Ball (RS17) Substation SEC 1, T2S, R6E
<i>Intermediate point</i>	None
<i>Point of Termination</i>	Ball (RS17) Substation SEC 1, T2S, R6E
<i>Length</i>	0

**Routing**

No new line construction. Loop-in 230kV lines that are adjacent to the site.

**Purpose**

Service to customer load in the Gilbert/Queen Creek area.

**Schedule**

<i>Right of Way/ Property Acquisition</i>	None
<i>Construction Start</i>	To be determined
<i>Estimated In-Service</i>	To be determined

**Notes**

***Rogers – Santan 230kV line (TBD)******Size***

<i>Voltage</i>	230kV
<i>Capacity</i>	Approximately 875 MVA
<i>Point of Origin</i>	Rogers Substation SEC 13, T1N, R5E
<i>Intermediate point</i>	None
<i>Point of Termination</i>	Santan Substation SEC 21, T1S, R6E
<i>Length</i>	Approximately 9 miles

***Routing***

To be determined through environmental and public processes, but generally east and south from Rogers, using existing circuit positions on existing structures, where possible.

***Purpose***

Provide adequate transmission facilities to deliver reliable power and energy to SRP's customers in the eastern valley area.

***Schedule***

<i>Right of Way/ Property Acquisition</i>	To be determined
<i>Construction Start</i>	To be determined
<i>Estimated In-Service</i>	To be determined

***Notes***

SRP does not hold a CEC for this project, but will be seeking a Certificate subsequent to an environmental and public process to site the line.

**Silver King – Browning 230kV line (TBD)****Size**

<i>Voltage</i>	230kV
<i>Capacity</i>	Approximately 875 MVA
<i>Point of Origin</i>	Silver King Substation Parts of SEC 15 & 16, T1S, R13E
<i>Intermediate point</i>	none
<i>Point of Termination</i>	Browning 500/230kV Substation SEC 12, T1S, R7E
<i>Length</i>	38 miles

**Routing**

From Silver King in a westerly direction to Browning.

**Purpose**

To deliver Coronado or other power in eastern Arizona into SRP's distribution service territory.

**Schedule**

<i>Right of Way/ Property Acquisition</i>	To be determined
<i>Construction Start</i>	To be determined
<i>Estimated In-Service</i>	To be determined

**Notes**

A CEC exists for the segment of this line from the Browning Substation to a point on the Silver King – Kyrene 500kV line corridor in Apache Junction (T1S, R8E, Section 11 & 12) (Case No. 20). Case #20 CEC has no expiration. A CEC for the remainder of the proposed line will need to be acquired.

**Superior 230kV Loop-in (TBD)****Size**

<i>Voltage</i>	230kV
<i>Capacity</i>	Approximately 875 MVA
<i>Point of Origin</i>	Point on the Silver King to Browning 230kV line SEC 34, T1S, R12E
<i>Intermediate point</i>	None
<i>Point of Termination</i>	Superior Substation SEC 34, T1S, R12E
<i>Length</i>	Approximately ½ mile

**Routing**

Southeast from the proposed Silver King to Browning line to the existing Superior Substation.

**Purpose**

To provide adequate transmission capacity in the event of future load growth in SRP's eastern service area.

**Schedule**

<i>Right of Way/ Property Acquisition</i>	To be determined
<i>Construction Start</i>	To be determined
<i>Estimated In-Service</i>	To be determined

**Notes**

SRP does not hold a CEC for this project, but will be seeking a Certificate subsequent to an environmental and public process to site the line.

**Thunderstone – Browning 230kV line (TBD)****Size**

<i>Voltage</i>	230kV
<i>Capacity</i>	Approximately 875 MVA
<i>Point of Origin</i>	Thunderstone Substation SEC 18, T1N, R7E
<i>Intermediate point</i>	none
<i>Point of Termination</i>	Browning Substation SEC 12, T1S, R7E
<i>Length</i>	Approximately 8 miles

**Routing**

Adjacent to, or within existing transmission ROW, or rebuild a WAPA circuit to accommodate a second circuit position.

**Purpose**

To provide additional transfer capability from the south and east to the north and central areas of SRP's service territory

**Schedule**

<i>Right of Way/ Property Acquisition</i>	To be determined
<i>Construction Start</i>	To be determined
<i>Estimated In-Service</i>	To be determined

**Notes**

This circuit may be on structures rebuilt to accommodate double circuit lines. This project may require a CEC depending on final configuration.

***Pinnacle Peak – Brandow 230kV (TBD)******Size***

<i>Voltage</i>	230kV
<i>Capacity</i>	Approximately 875 MVA
<i>Point of Origin</i>	Pinnacle Peak Substation SEC 10, T4N, R4E
<i>Intermediate point</i>	Possibly Rogers or Thunderstone Substation
<i>Point of Termination</i>	Brandow Substation SEC 11, T1N, R4E
<i>Length</i>	To be determined

***Routing***

Use of available circuit position on existing SRP Pinnacle Peak – Papago Buttes 230kV structures from Pinnacle Peak to Brandow. If connections to Rogers or Thunderstone are made, then the routing would generally be easterly from a point on the line to a termination at either Rogers or Thunderstone.

***Purpose***

Provide adequate transmission capacity to accommodate SRP customer load.

***Schedule***

<i>Right of Way/ Property Acquisition</i>	To be determined
<i>Construction Start</i>	To be determined
<i>Estimated In-Service</i>	To be determined

***Notes***

A CEC was awarded for this circuit as a part of Case No. 69, Pinnacle Peak – Brandow/Papago Buttes 230kV line, in January 1985. This CEC has no expiration.

**Browning – Corbell 230kV line (TBD)****Size**

<i>Voltage</i>	230kV
<i>Capacity</i>	Approximately 875 MVA
<i>Point of Origin</i>	Browning Substation SEC 12, T1S, R7E
<i>Intermediate point</i>	None
<i>Point of Termination</i>	Corbell Substation SEC 10, T1S, R5E
<i>Length</i>	Approximately 14 miles

**Routing**

Use of available circuit position on existing 230kV structures in the area.

**Purpose**

Provide adequate transmission capacity to accommodate future load growth.

**Schedule**

<i>Right of Way/ Property Acquisition</i>	Previously acquired
<i>Construction Start</i>	To be determined
<i>Estimated In-Service</i>	To be determined

**Notes**

SRP will be using an open position on existing double circuit structures for its entirety. A portion of the line and structures were constructed prior to the siting statutes and a portion was constructed as part of the RS-18 (Browning)-Santan project.

**Silver King – Knoll – New Hayden 230kV (TBD)****Size**

<i>Voltage</i>	230kV
<i>Capacity</i>	Approximately 875 MVA
<i>Point of Origin</i>	Silver King Substation Parts of SEC 15 & 16, T1S, R13E
<i>Intermediate point</i>	Knoll Substation SEC 23, T3S, R13E
<i>Point of Termination</i>	New Hayden Substation SEC 7, T5S, R15E
<i>Length</i>	Approximately 35 miles

**Routing**

South from Silver King, looped into Knoll, continuing to the Hayden area.

**Purpose**

To increase the transmission capacity to serve a new mining load.

**Schedule**

<i>Right of Way/ Property Acquisition</i>	To be determined
<i>Construction Start</i>	To be determined
<i>Estimated In-Service</i>	Contingent upon customer need

**Notes**

SRP does not hold a CEC for this project, but will be seeking a Certificate subsequent to an environmental and public process to site the line.

***New Hayden 115kV Station Loop-in (TBD)******Size***

<i>Voltage</i>	115kV
<i>Capacity</i>	Approximately 190 MVA
<i>Point of Origin</i>	Point on Kearny - Hayden 115kV Line SEC 7, T5S, R15E
<i>Intermediate point</i>	None
<i>Point of Termination</i>	New Hayden Substation SEC 7, T5S, R15E
<i>Length</i>	Approximately $\frac{3}{4}$ mile

***Routing***

Southwest from the existing Kearny - Hayden 115kV line to the New Hayden Transmission Station.

***Purpose***

To increase the transmission capacity to serve a new mining load.

***Schedule***

<i>Right of Way/ Property Acquisition</i>	To be determined
<i>Construction Start</i>	To be determined
<i>Estimated In-Service</i>	Contingent upon customer need

***Notes***

SRP does not hold a CEC for this project, but will be seeking a Certificate subsequent to an environmental and public process to site the line.

**RS25 Project (TBD)****Size**

<i>Voltage</i>	115kV, 230kV, or 345kV
<i>Capacity</i>	To be determined
<i>Point of Origin</i>	To be determined
<i>Intermediate point</i>	To be determined
<i>Point of Termination</i>	Future RS25 Substation
<i>Length</i>	To be determined

**Routing**

The RS25 Substation and transmission lines locations and route will be determined following a siting/environmental/public process.

**Purpose**

Serve growing Salt River Project – Maricopa Indian Community (SRP-MIC) load.

**Schedule**

<i>Right of Way/ Property Acquisition</i>	To be determined
<i>Construction Start</i>	To be determined
<i>Estimated In-Service</i>	To be determined

**Notes**

SRP does not hold a CEC for this project, but will be seeking a Certificate subsequent to an environmental and public process to site the line.

**RS26 Project (TBD)****Size**

<i>Voltage</i>	115kV, 230kV, or 345kV
<i>Capacity</i>	To be determined
<i>Point of Origin</i>	To be determined
<i>Intermediate point</i>	To be determined
<i>Point of Termination</i>	Future RS26 Substation (also known informally as Fountain Hills Station) Northeast Scottsdale/Fountain Hills area
<i>Length</i>	To be determined

**Routing**

The RS26 Substation and transmission lines locations and route will be determined following a federal facilities siting/environmental/public process.

**Purpose**

Provide a source for the development occurring in and around the Fountain Hills area, as well as relieve the stress on the lower voltage system currently supplying the Fountain Hills/Rio Verde area. The project is needed primarily to serve the proposed development in the Preserves at Goldfield Ranch northeast of Fountain Hills.

**Schedule**



<i>Right of Way/ Property Acquisition</i>	To be determined
<i>Construction Start</i>	To be determined
<i>Estimated In-Service</i>	To be determined

**Notes**

SRP does not hold a CEC for this project, but will be seeking a Certificate subsequent to an environmental and public process to site the line.

**Attachment**

***Attachment 1 – Ten Year Plan Technical Analysis***



# **[SALT RIVER PROJECT TEN YEAR PLAN TECHNICAL STUDY]**

Power flow and stability work performed on the 2020 transmission system.

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## **Executive Summary**

The power flow and stability assessment was performed on the 2020 transmission system and monitored SRP facilities to identify any potential violations due to simulated outages. The simulated outages studied were defined by NERC TPL-002 Category B, Table 1 (shown in Appendix A), which is an initiated single line to ground or three phase fault with normal clearing and then loss of a generator, transmission line, or transformer.

The power flow analysis of the 2020 system determined that there were no thermal overloads on the SRP system for all lines in service or for the single contingencies. The transient stability results revealed that the system remains stable following the defined outages.

## **Study Details**

The following sections highlight the details in performing this analysis.

### ***Power Flow case***

The WECC approved *20HS1* bulk case was used for the Ten Year Plan study work. The case was updated by SRP and APS to represent the most accurate Arizona system. The *sm20#29\_r1* case represents the latest transmission and sub-transmission, load forecast, and resource plans of utilities and independent power producers. Power flow and transient stability analysis were simulated using the *sm20#29\_r1* case. The system ratings for SRP's facilities used in this study can be found in Appendix B.

### ***Internal Planning Criteria***

SRP uses the following criteria for planning its system.

All lines in service conditions will not result in overloaded electric facilities:

- 525/230kV and 230/115kV transformers will not be loaded on more than 100% of the transformer nominal rating
- 230/69kV transformers will not be loaded to more than 100% of the transformer nominal rating
- 500kV, 230kV, 115kV or 69kV lines and substation conductors will not be loaded in excess of 100% of their summer normal limit
- Equipment high voltage limits will not be exceeded for normal conditions (n-0) or for the energizing or de-energizing of transmission lines
- Customer service entrance voltage limits (high or low) will not be violated for normal conditions (n-0). These limits are described below.
  - 230kV& above: the voltage shall not be below 1.0 pu
  - 115kV& 69kV: the voltage magnitude will not drop below the minimum established by ANSI (standard #C84.1-1989 or most current edition, Ref 42) for service entrance voltages as reflected

on the high side of the transformer.

- Under normal conditions the net VAR flow interchange with each individual neighboring utility shall be minimized and maintained near zero

SINGLE CONTINGENCY outage conditions will not result in overloaded electric facilities:

- 525/230kV, 230/69kV and 230/115kV transformers will not be loaded to more than 100% of emergency limit
- 500kV, 230kV, 115kV, and 69kV lines and substation conductors will not be loaded in excess of 100% of their emergency limit
- Equipment voltage limits (high or low) will not be exceeded for single contingency outages or for the energizing or de-energizing of transmission lines
- Customer service entrance voltages will be maintained within the high/low established limits for SINGLE CONTINGENCY outages.

These limits are described below.

- 230kV & above: the voltage deviation at any bus shall not exceed 5% of the pre-outage voltage
  - 115kV & 69kV: the voltage magnitude will not drop below the minimum established by ANSI (standard #C84.1-1989 or most current edition) for service entrance voltages as reflected on the high side of the transformer
  - 230kV: Single Contingency outages at 230kV or higher system voltages (including 230/69kV transformers) will not result in loss of load
- SYSTEM STABILITY: All machines in the system are to remain in synchronism with the system as demonstrated by their relative rotor angles
  - SYSTEM DAMPING: System damping will exist as demonstrated by the damping of relative rotor angle swings and the damping of voltage magnitude swings
  - TRANSIENT VOLTAGE DIP: Voltage swings initiated by a simulated system disturbance shall not cause the voltage at system busses to exceed those limits specified in the TPL-001 through TPL-004;
  - POST TRANSIENT VOLTAGE: After fault clearing, steady state system voltages shall remain within those limits specified in the TPL-001 through TPL-004;
  - TRANSIENT FREQUENCY DIP: Frequency swings initiated by a simulated system disturbance shall not cause the frequency at system busses to exceed those limits specified in the TPL-001 through TPL-004.

## ***Contingency lists***

### **Power Flow**

SRP developed a contingency list that simulated the outages of all the transmission line and the transformers in Arizona. The transmission line outages include voltage at 500kV, 230kV, and 115kV while the transformer outages include voltage at 500/230kV, 230/69kV and 230/115kV. The power flow contingencies can be found in the Appendix C.

### **Stability**

SRP developed a contingency list that simulated the fault of all the SRP transmission facilities for the following voltages: 500kV, 230kV and 115kV. The subsequent element at the bus was taken out of service after the fault. The list of studied faults for the transient stability analysis can be found in Appendix E.

## **Results**

### ***Power Flow***

The base case has no thermal overloads on SRP facilities within the valley boundaries. The power flow study revealed that for a single contingency there are no thermal or voltage deviation violations on the SRP system with all the projects proposed in the Ten Year Plan. The complete results of the power flow study can be found in Appendix D.

### ***Stability***

The transient stability analysis revealed that the base case was stable. For simulation of faults on SRP facilities, the system was stable and damped. The voltage and frequency at valley buses were within acceptable limits. Due to the volume of plots, the graphs for the transient stability will be made available upon request, as noted in Appendix F.

## **Conclusion**

The power flow and transient stability analysis were performed on the 2020 case with all the proposed projects in the Ten Year Plan being in-service. The single contingencies were simulated on SRP's system according to the NERC TPL-002 standard, Category B Table 1. SRP's system performed within the thermal, voltage, and transient stability boundaries for the studied outages with all the projects proposed in the Ten Year Plan. There was no reporting of any violation for the outages simulated on SRP's system.

## **APPENDIX**

## Appendix A – TPL-002a Table 1

### Standard TPL-002-0a — System Performance Following Loss of a Single BES Element

Table I. Transmission System Standards — Normal and Emergency Conditions

Category	Contingencies	System Limits or Impacts		
	Initiating Event(s) and Contingency Element(s)	System Stable and both Thermal and Voltage Limits within Applicable Rating <sup>a</sup>	Loss of Demand or Curtailed Firm Transfers	Cascading Outages
A No Contingencies	All Facilities in Service	Yes	No	No
B Event resulting in the loss of a single element.	Single Line Ground (SLG) or 3-Phase (3Ø) Fault, with Normal Clearing:	Yes	No <sup>a</sup>	No
	1. Generator	Yes	No <sup>b</sup>	No
	2. Transmission Circuit	Yes	No <sup>b</sup>	No
	3. Transformer	Yes	No <sup>b</sup>	No
	Loss of an Element without a Fault.			
	Single Pole Block, Normal Clearing <sup>c</sup> :	Yes	No <sup>b</sup>	No
	4. Single Pole (dc) Line			

## Appendix B – System Ratings

Voltage (kV)	From Bus	To Bus	Circuit	Continuous Rating (MVA 1)	Emergency Rating (MVA 2)
115	ASARCOSR	ASARCOTAP	1	80.7	95.6
115	ASARCOTAP	HAYDENAZ	1	120.5	142.4
115	ASARCOTAP	CRUSHER	1	120.5	142.4
115	BONNEYTAP	COOLIDGE	1	119.5	139.4
115	BONNEYTAP	CRUSHER	1	120.5	142.4
115	CARLOTA	PINTOVALLEY	1	161.3	192.2
115	CARLOTA	SILVERKING TAP 2	1	161.3	192.2
115	CARREL	GOLDFIELD	1	160.3	190.2
115	CARREL	SPURLOCK	1	161.3	192.2
115	ELLISON	GASCLEAN	1	164.3	194.2
115	FRAZIER	MOONSHINE	1	161.3	191.2
115	FRAZIER	ROOSEVELT	1	58.8	58.8
115	FRAZIER	HORSEMESA	1	161.3	191.2
115	GASCLEAN	GASCLEAN TAP	1	164.3	194.2
115	GOLDFIELD	HORSEMESA	1	181.3	216.1
115	GOLDFIELD	STEWART MOUNTAIN TAP	1	160.3	190.2
115	HAYDENAZ	KEARNYTAP	1	120.5	142.4
115	HORSEMESA	MORMANFLAT	1	161.3	192.2
115	KEARNY	KEARNYTAP	1	160.3	190.2
115	KEARNYTAP	MORRISAZ	1	119.5	119.5
115	KNOLL	MORRISAZ	1	119.5	119.5
115	MIAMI	PINAL	1	139.4	139.4
115	MIAMI	PINTOVALLEY	1	159.4	159.4
115	MIAMI	MIAMI 3	1	161.3	189.3
115	MIAMI 3	PINAL	1	120.5	142.4
115	MIAMI 3	MIAMI 4	1	159.4	159.4
115	MIAMI 4	GASCLEAN TAP	1	159.4	159.4
115	MOONSHINE	PINAL	1	159.4	159.4
115	MOONSHINE	REFINERY TAP	1	119.5	119.5
115	OAKFLAT	SILVERKING TAP	1	161.3	192.2
115	OAKFLAT	TRASK	1	161.3	192.2
115	PINAL	SILVERKING TAP 1	1	161.3	189.2
115	PINAL	SILVERKING TAP	1	161.3	192.2
115	RAY	KNOLL	1	161.3	192.2
115	RAY	SUPERIOR	1	161.3	192.2

115	REFINERY	REFINERY TAP	1	39.8	39.8
115	REFINERY TAP	GASCLEAN TAP	1	161.3	192.2
115	SILVERKING	SILVERKING TAP 2	1	322.7	384.4
115	SILVERKING	SILVERKING TAP 1	1	322.7	384.4
115	SILVERKING TAP 2	SUPERIOR	1	161.3	192.2
115	SPURLOCK	SUPERIOR	1	161.3	191.2
115	STEWART MOUNTAINTAP	MORMANFLAT	1	161.3	192.2
115	STEWART MOUNTAINTAP	STEWART MOUNTAIN	1	59.8	59.8
115	SUPERIOR	TRASK	1	161.3	192.2
230	ABEL	DINOSAUR	1	822.6	904.3
230	ABEL	SCHRADER	1	822.6	904.3
230	ABEL	RS-24	1	822.6	904.3
230	ABEL	RS-24	2	822.6	904.3
230	ABEL	RANDOLPH	1	1195.1	1513.8
230	AGUAFRIA	WESTWING	1	796.7	796.7
230	AGUAFRIA	ALEXANDER	1	780.8	796.7
230	AGUAFRIA	WHITETANKS	1	722.8	912.3
230	ANDERSON	KYRENE-NEW	1	780.8	796.7
230	BRANDOW	KYRENE	1	772.8	912.3
230	BRANDOW	PAPAGOBUTTE	1	772.8	912.3
230	BRANDOW	WARD	1	362.5	432.2
230	BRANDOW	WARD	2	362.5	432.2
230	BROWNING	SANTAN	1	772.8	904.3
230	BROWNING	RANDOLPH	1	1195.1	1513.8
230	BROWNING	DINOSAUR	1	822.6	904.3
230	CORBELL	KYRENE	1	772.8	912.3
230	DEERVALLEY	WESTWING	1	780.8	876.4
230	DEERVALLEY	ALEXANDR	1	720	815.9
230	DEERVALLEY	PINNACLE PEAK SRP	1	637.4	796.7
230	KYRENE	KYRENE-NEW	1	1195.1	1195.1
230	KYRENE	SCHRADER	1	725	864.5
230	MESQUITE	MESQUITE SOLAR	1	390.4	462.1
230	MESQUITE	MESQUITE SOLAR	2	390.4	462.1
230	ORME	ANDERSON	2	772.8	796.7
230	ORME	RUDD	1	780.8	924.2
230	ORME	RUDD	2	780.8	924.2
230	ORME	ANDERSON	1	772.8	796.7
230	PAPAGOBUTTE	PINNACLE PEAK SRP	1	772.8	796.7
230	PAPAGOBUTTE	KYRENE-NEW	1	683.2	750.9
230	PINAL CENTRAL	DESERT BASIN	1	822.6	904.3

230	PINAL CENTRAL	RANDOLPH	1	1195	1513.8
230	PINNACLE PEAK SRP	BRANDOW	1	386.4	456.1
230	PINNACLE PEAK SRP	BRANDOW	2	386.4	456.1
230	ROGERS	THUNDERSTONE	1	386.4	456.1
230	RUDD	WHITETANKS	1	772.8	912.3
230	SANTAN	CORBELL	1	725	864.5
230	SANTAN	THUNDERSTONE	1	770	770
230	SANTAN	RS-24	1	822.6	904.3
230	SCHRADER	SANTAN	1	772.8	796.7
230	SCHRADER	RS-24	1	822.6	904.3
230	SILVERKING	GOLDFIELD	1	645.4	768.9
230	THUNDERSTONE	GOLDFIELD	1	390.4	462.1
230	THUNDERSTONE	GOLDFIELD	2	390.4	462.1
500	ABEL	BROWNING	1	2970.5	3550.7
500	BROWNING	SILVERKING	1	2355.6	2788.6
500	CORONADO	SUGARLOAF	1	1732	1732.1
500	CORONADO	SILVERKING	1	1732	2338.3
500	HASSAYAMPA	PALOVERDE	1	2970.5	3550.7
500	HASSAYAMPA	PALOVERDE	2	2970.5	3550.7
500	HASSAYAMPA	PALOVERDE	3	2165	2165
500	HASSAYAMPA	PINAL WEST	1	2970.5	3550.7
500	HASSAYAMPA	JOJOBA	1	2970.5	3550.7
500	HASSAYAMPA	ARLINGTON	1	3000	3000
500	HASSAYAMPA	HARQUAHALA	1	3000	3000
500	JOJOBA	KYRENE	1	2823.2	2886.5
500	KYRENE	BROWNING	1	2886.5	2886.5
500	PALOVERDE	RUDD	1	2823.2	3360.2
500	PALOVERDE	DELANY	1	2598	2598
500	PERKINS	WESTWING	1	2598.1	2598.1
500	PERKINS	PERKINS PS	1	2598.1	2598.1
500	PERKINS PS	PERKINS PS1	1	1732.1	1732.1
500	PERKINS PS2	PERKINS PS	1	1732.1	1732.1
500	PINAL CENTRAL	ABEL	1	2970.5	3550.7
500	PINAL CENTRAL	SANTAROSA	1	2970.5	3550.7
500	PINAL CENTRAL	TORTOLITA	1	2970.5	3550.7
500	PINAL WEST	SANTAROSA	1	2970.5	3550.7
500	SUGARLOAF	CHOLLA	1	1957.2	2165.1

## ***Appendix C – Contingency List***

line\_1 "Line CHOLLA 500.0 to SAGUARO 500.0 Circuit 1" 1.000  
line\_2 "Line CHOLLA 500.0 to SILVERKG 500.0 Circuit 1" 1.000  
line\_3 "Line FOURCORN 500.0 to MOENKOPI 500.0 Circuit 1" 1.000  
line\_4 "Line FOURCORN 500.0 to FCW 500.0 Circuit 1" 1.000  
line\_5 "Line MOENKOPI 500.0 to YAVAPAI 500.0 Circuit 1" 1.000  
line\_6 "Line MOENKOPI 500.0 to RME 500.0 Circuit 1" 1.000  
line\_7 "Line NAVAJO 500.0 to MOENKOPI 500.0 Circuit 1" 1.000  
line\_8 "Line NAVAJO 500.0 to DUGAS 500.0 Circuit 1" 1.000  
line\_9 "Line NAVAJO 500.0 to RME 500.0 Circuit 1" 1.000  
line\_10 "Line SAGUARO 500.0 to TORTOLIT 500.0 Circuit 2" 1.000  
line\_11 "Line SAGUARO 500.0 to TORTLIT2 500.0 Circuit 1" 1.000  
line\_12 "Line YAVAPAI 500.0 to WESTWING 500.0 Circuit 1" 1.000  
line\_13 "Line SNVLY 500.0 to MORGAN 500.0 Circuit 1" 1.000  
line\_14 "Line MORGAN 500.0 to WESTWING 500.0 Circuit 1" 1.000  
line\_15 "Line MORGAN 500.0 to PNPKAPS 500.0 Circuit r1" 1.000  
line\_16 "Line DELANY 500.0 to SNVLY 500.0 Circuit 1" 1.000  
line\_17 "Line SGRLF 500.0 to CHOLLA 500.0 Circuit 1" 1.000  
line\_18 "Line DUGAS 500.0 to MORGAN 500.0 Circuit 1" 1.000  
line\_19 "Line DRPP 500.0 to FCW 500.0 Circuit 1" 1.000  
line\_20 "Line DRPP 500.0 to FCW 500.0 Circuit 2" 1.000  
line\_21 "Line RME 500.0 to FCW 500.0 Circuit 1" 1.000  
line\_22 "Line CHOLLA 345.0 to PNPKAPS 345.0 Circuit 1" 1.000  
line\_23 "Line CHOLLA 345.0 to PRECHCYN 345.0 Circuit 1" 1.000  
line\_24 "Line FOURCORN 345.0 to CHOLLA 345.0 Circuit 1" 1.000  
line\_25 "Line FOURCORN 345.0 to CHOLLA 345.0 Circuit 2" 1.000  
line\_26 "Line PRECHCYN 345.0 to PNPKAPS 345.0 Circuit 1" 1.000  
line\_27 "Line MAZATZAL 345.0 to PNPKAPS 345.0 Circuit 1" 1.000  
line\_28 "Line CACTUS 230.0 to OCOTILLO 230.0 Circuit 1" 1.000  
line\_29 "Line CHOLLA 230.0 to LEUPP 230.0 Circuit 1" 1.000  
line\_30 "Line COCONINO 230.0 to VERDE S 230.0 Circuit 1" 1.000  
line\_31 "Line CTRYCLUB 230.0 to LINCSTRT 230.0 Circuit 1" 1.000  
line\_32 "Line CTRYCLUB 230.0 to GRNDTRML 230.0 Circuit 1" 1.000  
line\_33 "Line DEERVALY 230.0 to WESTWNGE 230.0 Circuit 1" 1.000  
line\_34 "Line DEERVALY 230.0 to ALEXANDR 230.0 Circuit 1" 1.000  
line\_35 "Line DEERVALY 230.0 to PINPKSRP 230.0 Circuit 1" 1.000  
line\_36 "Line EAGLEYE 230.0 to LIBERTY 230.0 Circuit 1" 1.000  
line\_37 "Line EL SOL 230.0 to AGUAFRIA 230.0 Circuit 1" 1.000  
line\_38 "Line GLENDALE 230.0 to GRNDTRML 230.0 Circuit 1" 1.000  
line\_39 "Line LEUPP 230.0 to COCONINO 230.0 Circuit 1" 1.000  
line\_40 "Line LINCSTRT 230.0 to OCOTILLO 230.0 Circuit 1" 1.000  
line\_41 "Line LINCSTRT 230.0 to WPHXAPSN 230.0 Circuit 1" 1.000  
line\_42 "Line LONEPEAK 230.0 to SUNYSLOP 230.0 Circuit 1" 1.000  
line\_43 "Line MEADOWBK 230.0 to CTRYCLUB 230.0 Circuit 1" 1.000  
line\_44 "Line MEADOWBK 230.0 to SUNYSLOP 230.0 Circuit 1" 1.000  
line\_45 "Line REACH 230.0 to LONEPEAK 230.0 Circuit 1" 1.000  
line\_46 "Line PPAPS W 230.0 to PINPK 230.0 Circuit 1" 1.000

line\_47 "Line JOJOBA 230.0 to GILARIVR 230.0 Circuit 1" 1.000  
 line\_48 "Line SAGUARO 230.0 to TATMOMLI 230.0 Circuit 1" 1.000  
 line\_49 "Line SNTAROSA 230.0 to TATMOMLI 230.0 Circuit 1" 1.000  
 line\_50 "Line SNTAROSA 230.0 to TESTTRAK 230.0 Circuit 1" 1.000  
 line\_51 "Line SURPRISE 230.0 to EL SOL 230.0 Circuit 1" 1.000  
 line\_52 "Line SURPRISE 230.0 to WESTWNGW 230.0 Circuit 1" 1.000  
 line\_53 "Line VERDE N 230.0 to VERDE S 230.0 Circuit 1" 1.000  
 line\_54 "Line WESTWNGW 230.0 to EL SOL 230.0 Circuit 1" 1.000  
 line\_55 "Line WESTWNGW 230.0 to WESTWNGE 230.0 Circuit 1" 1.000  
 line\_56 "Line SNVLY 230.0 to HASSY AZ 230.0 Circuit 1" 1.000  
 line\_57 "Line WESTWNGW 230.0 to PINPK 230.0 Circuit 1" 1.000  
 line\_58 "Line WHTNKAPS 230.0 to EL SOL 230.0 Circuit 1" 1.000  
 line\_59 "Line WHTNKAPS 230.0 to RUDD 230.0 Circuit 1" 1.000  
 line\_60 "Line WPHXAPSS 230.0 to WPHXAPSN 230.0 Circuit 1" 1.000  
 line\_61 "Line WPHXAPSS 230.0 to RUDD 230.0 Circuit 1" 1.000  
 line\_62 "Line YAVAPAI 230.0 to VERDE N 230.0 Circuit 1" 1.000  
 line\_63 "Line YAVAPAI 230.0 to WILOWLKE 230.0 Circuit 1" 1.000  
 line\_64 "Line KYR-NEW 230.0 to OCOTILLO 230.0 Circuit 1" 1.000  
 line\_65 "Line KYR-NEW 230.0 to KNOX 230.0 Circuit 1" 1.000  
 line\_66 "Line GILARIVR 230.0 to GILABEND 230.0 Circuit 1" 1.000  
 line\_67 "Line WPHXAPSN 230.0 to WHTNKAPS 230.0 Circuit 1" 1.000  
 line\_68 "Line FORTROCK 230.0 to ROUNDVLY 230.0 Circuit 1" 1.000  
 line\_69 "Line FORTROCK 230.0 to JUNIPRMT 230.0 Circuit 1" 1.000  
 line\_70 "Line RACEWAY 230.0 to RACEWYWA 230.0 Circuit 1" 1.000  
 line\_71 "Line GLENDALW 230.0 to GLENDALE 230.0 Circuit 1" 1.000  
 line\_72 "Line GLENDALW 230.0 to AGUAFRIA 230.0 Circuit 1" 1.000  
 line\_73 "Line WILOWLKW 230.0 to PRESCOTT 230.0 Circuit 1" 1.000  
 line\_74 "Line WILOWLKW 230.0 to WILOWLKE 230.0 Circuit 1" 1.000  
 line\_75 "Line AVERY 230.0 to RACEWAY 230.0 Circuit 1" 1.000  
 line\_76 "Line AVERY 230.0 to SCTWSH 230.0 Circuit 1" 1.000  
 line\_77 "Line TRLBY 230.0 to TS2 230.0 Circuit 1" 1.000  
 line\_78 "Line TRLBY 230.0 to SNVLY 230.0 Circuit 1" 1.000  
 line\_79 "Line TS2 230.0 to PLMVLY 230.0 Circuit 1" 1.000  
 line\_80 "Line SCTWSH 230.0 to PPAPS W 230.0 Circuit 1" 1.000  
 line\_81 "Line TS4 230.0 to JOJOBA 230.0 Circuit 1" 1.000  
 line\_82 "Line TS4 230.0 to PLMVLY 230.0 Circuit 1" 1.000  
 line\_83 "Line JUNIPRMT 230.0 to SELIGMAN 230.0 Circuit 1" 1.000  
 line\_84 "Line MILLIGAN 230.0 to CASGRAPS 230.0 Circuit 1" 1.000  
 line\_85 "Line ADAMS 115.0 to ADAMS TP 115.0 Circuit 1" 1.000  
 line\_86 "Line BONNYBKE 115.0 to BONNYBRK 115.0 Circuit 1" 1.000  
 line\_87 "Line SAG.EAST 115.0 to SAG.WEST 115.0 Circuit 1" 1.000  
 line\_88 "Line SAG.EAST 115.0 to MARANATP 115.0 Circuit 1" 1.000  
 line\_89 "Line SAG.EAST 115.0 to NAVISKA 115.0 Circuit 1" 1.000  
 line\_90 "Line SAG.EAST 115.0 to ORACLE 115.0 Circuit 1" 1.000  
 line\_91 "Line SAG.WEST 115.0 to SNMANUEL 115.0 Circuit 1" 1.000  
 line\_92 "Line SAG.WEST 115.0 to ED-5 115.0 Circuit 1" 1.000  
 line\_93 "Line SAG.WEST 115.0 to ED-5B 115.0 Circuit 1" 1.000  
 line\_94 "Line SNMANUEL 115.0 to HAYDENAZ 115.0 Circuit 1" 1.000

line\_95 "Line VLYFARMS 115.0 to ORACLE 115.0 Circuit 1" 1.000  
 line\_96 "Line BOOTHILL 115.0 to ADAMS 115.0 Circuit 1" 1.000  
 line\_97 "Line BOOTHILL 115.0 to MURAL 115.0 Circuit 1" 1.000  
 line\_98 "Line CORONADO 500.0 to SGRLF 500.0 Circuit 1" 1.000  
 line\_99 "Line CORONADO 500.0 to SILVERKG 500.0 Circuit 1" 1.000  
 line\_100 "Line PALOVRDE 500.0 to WESTWING 500.0 Circuit 1" 1.000  
 line\_101 "Line PALOVRDE 500.0 to WESTWING 500.0 Circuit 2" 1.000  
 line\_102 "Line PALOVRDE 500.0 to RUDD 500.0 Circuit 1" 1.000  
 line\_103 "Line SILVERKG 500.0 to SAGUARO 500.0 Circuit 1" 1.000  
 line\_104 "Line ABEL 500.0 to BROWNING 500.0 Circuit 1" 1.000  
 line\_105 "Line PINAL\_C 500.0 to ABEL 500.0 Circuit 1" 1.000  
 line\_106 "Line JOJOBA 500.0 to GILARIVR 500.0 Circuit 1" 1.000  
 line\_107 "Line JOJOBA 500.0 to GILARIVR 500.0 Circuit 2" 1.000  
 line\_108 "Line JOJOBA 500.0 to KYRENE 500.0 Circuit 1" 1.000  
 line\_109 "Line HASSYAMP 500.0 to PALOVRDE 500.0 Circuit 1" 1.000  
 line\_110 "Line HASSYAMP 500.0 to PALOVRDE 500.0 Circuit 2" 1.000  
 line\_111 "Line HASSYAMP 500.0 to PALOVRDE 500.0 Circuit 3" 1.000  
 line\_112 "Line HASSYAMP 500.0 to PINAL\_W 500.0 Circuit 1" 1.000  
 line\_113 "Line HASSYAMP 500.0 to JOJOBA 500.0 Circuit 1" 1.000  
 line\_114 "Line HASSYAMP 500.0 to ARLINTON 500.0 Circuit 1" 1.000  
 line\_115 "Line HASSYAMP 500.0 to HARQUAHA 500.0 Circuit 1" 1.000  
 line\_116 "Line HASSYAMP 500.0 to MESQUITE 500.0 Circuit 1" 1.000  
 line\_117 "Line BONNEYTP 115.0 to BONNYBRK 115.0 Circuit 1" 1.000  
 line\_118 "Line BONNEYTP 115.0 to COOLIDGE 115.0 Circuit 1" 1.000  
 line\_119 "Line ELLISON 115.0 to 843E2.7N 115.0 Circuit 1" 1.000  
 line\_120 "Line FRAZIER 115.0 to MOONSHIN 115.0 Circuit 1" 1.000  
 line\_121 "Line FRAZIER 115.0 to ROOSEVLT 115.0 Circuit 1" 1.000  
 line\_122 "Line GOLDFELD 115.0 to HORSMESSA 115.0 Circuit 1" 1.000  
 line\_123 "Line HAYDENAZ 115.0 to KEARNYTP 115.0 Circuit 1" 1.000  
 line\_124 "Line HORSMESSA 115.0 to MRMNFLAT 115.0 Circuit 1" 1.000  
 line\_125 "Line KEARNYTP 115.0 to MORRISAZ 115.0 Circuit 1" 1.000  
 line\_126 "Line KNOLL 115.0 to MORRISAZ 115.0 Circuit 1" 1.000  
 line\_127 "Line MIAMI 115.0 to PINAL 115.0 Circuit 1" 1.000  
 line\_128 "Line MIAMI 115.0 to PINTOVLY 115.0 Circuit 1" 1.000  
 line\_129 "Line MIAMI 115.0 to 843E2.7N 115.0 Circuit 1" 1.000  
 line\_130 "Line MOONSHIN 115.0 to PINAL 115.0 Circuit 1" 1.000  
 line\_131 "Line MOONSHIN 115.0 to 842E2.7N 115.0 Circuit 1" 1.000  
 line\_132 "Line OAKFLAT 115.0 to SILVERT1 115.0 Circuit 1" 1.000  
 line\_133 "Line PINAL 115.0 to SILVERT1 115.0 Circuit 1" 1.000  
 line\_134 "Line RAY 115.0 to KNOLL 115.0 Circuit 1" 1.000  
 line\_135 "Line RAY 115.0 to SUPERIOR 115.0 Circuit 1" 1.000  
 line\_136 "Line REFINERY 115.0 to 842E2.7N 115.0 Circuit 1" 1.000  
 line\_137 "Line SILVERK1 115.0 to SILVERT1 115.0 Circuit 1" 1.000  
 line\_138 "Line SILVERK2 115.0 to SUPERIOR 115.0 Circuit 1" 1.000  
 line\_139 "Line SPURLOCK 115.0 to SUPERIOR 115.0 Circuit 1" 1.000  
 line\_140 "Line 842E2.7N 115.0 to 843E2.7N 115.0 Circuit 1" 1.000  
 line\_141 "Line SNYDHLAZ 115.0 to SNYDHILL 115.0 Circuit 1" 1.000  
 line\_142 "Line AGUAFRIA 230.0 to WESTWNGW 230.0 Circuit 1" 1.000

line\_143 "Line AGUAFRIA 230.0 to ALEXANDR 230.0 Circuit 1" 1.000  
 line\_144 "Line AGUAFRIA 230.0 to WHITETNK 230.0 Circuit 1" 1.000  
 line\_145 "Line BRANDOW 230.0 to KYRENE 230.0 Circuit 1" 1.000  
 line\_146 "Line BRANDOW 230.0 to PAPAGOB 230.0 Circuit 1" 1.000  
 line\_147 "Line BRANDOW 230.0 to WARD 230.0 Circuit 1" 1.000  
 line\_148 "Line BRANDOW 230.0 to WARD 230.0 Circuit 2" 1.000  
 line\_149 "Line CORBELL 230.0 to KYRENE 230.0 Circuit 1" 1.000  
 line\_150 "Line KYRENE 230.0 to KYR-NEW 230.0 Circuit 1" 1.000  
 line\_151 "Line KYRENE 230.0 to SCHRADER 230.0 Circuit 1" 1.000  
 line\_152 "Line ORME 230.0 to ANDERSON 230.0 Circuit 2" 1.000  
 line\_153 "Line ORME 230.0 to RUDD 230.0 Circuit 1" 1.000  
 line\_154 "Line ORME 230.0 to RUDD 230.0 Circuit 2" 1.000  
 line\_155 "Line PAPAGOB 230.0 to PINPKSRP 230.0 Circuit 1" 1.000  
 line\_156 "Line PINPKSRP 230.0 to BRANDOW 230.0 Circuit 1" 1.000  
 line\_157 "Line PINPKSRP 230.0 to BRANDOW 230.0 Circuit 2" 1.000  
 line\_158 "Line ROGERS 230.0 to THUNDRST 230.0 Circuit 1" 1.000  
 line\_159 "Line ROGERS 230.0 to ROGSWAPA 230.0 Circuit 1" 1.000  
 line\_160 "Line ROGERS 230.0 to ROGSWAPA 230.0 Circuit 2" 1.000  
 line\_161 "Line SANTAN 230.0 to CORBELL 230.0 Circuit 1" 1.000  
 line\_162 "Line SANTAN 230.0 to THUNDRST 230.0 Circuit 1" 1.000  
 line\_163 "Line SCHRADER 230.0 to SANTAN 230.0 Circuit 1" 1.000  
 line\_164 "Line SILVERKG 230.0 to GOLDFELD 230.0 Circuit 1" 1.000  
 line\_165 "Line THUNDRST 230.0 to GOLDFELD 230.0 Circuit 1" 1.000  
 line\_166 "Line THUNDRST 230.0 to GOLDFELD 230.0 Circuit 2" 1.000  
 line\_167 "Line KNOX 230.0 to SNTAROSA 230.0 Circuit 1" 1.000  
 line\_168 "Line BROWNING 230.0 to SANTAN 230.0 Circuit 1" 1.000  
 line\_169 "Line ABEL 230.0 to DINOSAUR 230.0 Circuit 1" 1.000  
 line\_170 "Line RUDD 230.0 to PLMVLY 230.0 Circuit 1" 1.000  
 line\_171 "Line RUDD 230.0 to WHITETNK 230.0 Circuit 1" 1.000  
 line\_172 "Line GREENLEE 345.0 to WINCHSTR 345.0 Circuit 1" 1.000  
 line\_173 "Line GREENLEE 345.0 to WILLOW 345.0 Circuit 1" 1.000  
 line\_174 "Line GREENLEE 345.0 to COPPERVR 345.0 Circuit 1" 1.000  
 line\_175 "Line MCKINLEY 345.0 to SPRINGR 345.0 Circuit 1" 1.000  
 line\_176 "Line MCKINLEY 345.0 to SPRINGR 345.0 Circuit 2" 1.000  
 line\_177 "Line SOUTH 345.0 to GATEWAY 345.0 Circuit 1" 1.000  
 line\_178 "Line SOUTH 345.0 to GATEWAY 345.0 Circuit 2" 1.000  
 line\_179 "Line SPRINGR 345.0 to CORONADO 345.0 Circuit 1" 1.000  
 line\_180 "Line SPRINGR 345.0 to GREENLEE 345.0 Circuit 1" 1.000  
 line\_181 "Line SPRINGR 345.0 to VAIL2 345.0 Circuit 1" 1.000  
 line\_182 "Line VAIL 345.0 to SOUTH 345.0 Circuit 1" 1.000  
 line\_183 "Line WESTWING 345.0 to PINALWES 345.0 Circuit 1" 1.000  
 line\_184 "Line WINCHSTR 345.0 to VAIL 345.0 Circuit 1" 1.000  
 line\_185 "Line WINCHSTR 345.0 to WILLOW 345.0 Circuit 1" 1.000  
 line\_186 "Line WILLOW 345.0 to BOWIE 345.0 Circuit 1" 1.000  
 line\_187 "Line WILLOW 345.0 to BOWIE 345.0 Circuit 2" 1.000  
 line\_188 "Line PINALWES 345.0 to SOUTH 345.0 Circuit 1" 1.000  
 line\_189 "Line DMP 138.0 to N. LOOP 138.0 Circuit 1" 1.000  
 line\_190 "Line DMP 138.0 to NE.LOOP 138.0 Circuit 1" 1.000

line\_191 "Line DMP 138.0 to SN.CRUZ 138.0 Circuit 1" 1.000  
 line\_192 "Line DMP 138.0 to TUCSON 138.0 Circuit 1" 1.000  
 line\_193 "Line DREXEL 138.0 to IRVNGTN 138.0 Circuit 1" 1.000  
 line\_194 "Line DREXEL 138.0 to MIDVALE 138.0 Circuit 1" 1.000  
 line\_195 "Line E. LOOP 138.0 to NE.LOOP 138.0 Circuit 1" 1.000  
 line\_196 "Line E. LOOP 138.0 to ROBERTS 138.0 Circuit 1" 1.000  
 line\_197 "Line E. LOOP 138.0 to PANTANO 138.0 Circuit 1" 1.000  
 line\_198 "Line E. LOOP 138.0 to HARRISON 138.0 Circuit 1" 1.000  
 line\_199 "Line IRVNGTN 138.0 to SOUTH 138.0 Circuit 1" 1.000  
 line\_200 "Line IRVNGTN 138.0 to TUCSON 138.0 Circuit 1" 1.000  
 line\_201 "Line IRVNGTN 138.0 to VAIL 138.0 Circuit 2" 1.000  
 line\_202 "Line IRVNGTN 138.0 to TECHPARK 138.0 Circuit 1" 1.000  
 line\_203 "Line IRVNGTN 138.0 to KINO 138.0 Circuit 1" 1.000  
 line\_204 "Line MIDVALE 138.0 to SPNCER 138.0 Circuit 1" 1.000  
 line\_205 "Line N. LOOP 138.0 to RILLITO 138.0 Circuit 1" 1.000  
 line\_206 "Line N. LOOP 138.0 to WESTINA 138.0 Circuit 1" 1.000  
 line\_207 "Line N. LOOP 138.0 to MARANA 138.0 Circuit 1" 1.000  
 line\_208 "Line N. LOOP 138.0 to NARANJA 138.0 Circuit 1" 1.000  
 line\_209 "Line NE.LOOP 138.0 to RILLITO 138.0 Circuit 1" 1.000  
 line\_210 "Line NE.LOOP 138.0 to NELS\_SVC 138.0 Circuit 1" 1.000  
 line\_211 "Line RANVISTO 138.0 to LACANADA 138.0 Circuit 1" 1.000  
 line\_212 "Line RANVISTO 138.0 to SUN\_CITY 138.0 Circuit 1" 1.000  
 line\_213 "Line RANVISTO 138.0 to NARANJA 138.0 Circuit 1" 1.000  
 line\_214 "Line RILLITO 138.0 to LACANADA 138.0 Circuit 1" 1.000  
 line\_215 "Line ROBERTS 138.0 to HARRISON 138.0 Circuit 1" 1.000  
 line\_216 "Line S.TRAIL 138.0 to ROBERTS 138.0 Circuit 1" 1.000  
 line\_217 "Line SN.CRUZ 138.0 to IRVNGTN 138.0 Circuit 1" 1.000  
 line\_218 "Line SNYDER 138.0 to E. LOOP 138.0 Circuit 1" 1.000  
 line\_219 "Line SNYDER 138.0 to NE.LOOP 138.0 Circuit 1" 1.000  
 line\_220 "Line SNYDER 138.0 to CRYCROFT 138.0 Circuit 1" 1.000  
 line\_221 "Line SOUTH 138.0 to MIDVALE 138.0 Circuit 1" 1.000  
 line\_222 "Line SOUTH 138.0 to ASARCO 138.0 Circuit 1" 1.000  
 line\_223 "Line SOUTH 138.0 to CYPRUS 138.0 Circuit 1" 1.000  
 line\_224 "Line SOUTH 138.0 to GREENVLY 138.0 Circuit 1" 1.000  
 line\_225 "Line SOUTH 138.0 to HARTT 138.0 Circuit 1" 1.000  
 line\_226 "Line TORTOLIT 138.0 to N. LOOP 138.0 Circuit 1" 1.000  
 line\_227 "Line TORTOLIT 138.0 to N. LOOP 138.0 Circuit 2" 1.000  
 line\_228 "Line TORTOLIT 138.0 to RANVISTO 138.0 Circuit 1" 1.000  
 line\_229 "Line TORTOLIT 138.0 to MARANA 138.0 Circuit 1" 1.000  
 line\_230 "Line TUCSON 138.0 to DELCERRO 138.0 Circuit 1" 1.000  
 line\_231 "Line TUCSON 138.0 to KINO 138.0 Circuit 1" 1.000  
 line\_232 "Line TWNTYSEC 138.0 to E. LOOP 138.0 Circuit 1" 1.000  
 line\_233 "Line TWNTYSEC 138.0 to IRVNGTN 138.0 Circuit 1" 1.000  
 line\_234 "Line VAIL 138.0 to S.TRAIL 138.0 Circuit 1" 1.000  
 line\_235 "Line VAIL 138.0 to FT.HUACH 138.0 Circuit 1" 1.000  
 line\_236 "Line VAIL 138.0 to CIENEGA 138.0 Circuit 1" 1.000  
 line\_237 "Line RBWILMOT 138.0 to VAIL 138.0 Circuit 1" 1.000  
 line\_238 "Line LOSREALS 138.0 to VAIL 138.0 Circuit 1" 1.000

line\_239 "Line PANTANO 138.0 to LOSREALS 138.0 Circuit 1" 1.000  
 line\_240 "Line CANOARCH 138.0 to CYPRUS 138.0 Circuit 1" 1.000  
 line\_241 "Line DELCERRO 138.0 to WESTINA 138.0 Circuit 1" 1.000  
 line\_242 "Line GREENVLY 138.0 to CANOARCH 138.0 Circuit 1" 1.000  
 line\_243 "Line CORONA 138.0 to IRVNGTN 138.0 Circuit 1" 1.000  
 line\_244 "Line CORONA 138.0 to SOUTH 138.0 Circuit 1" 1.000  
 line\_245 "Line CRYCROFT 138.0 to NE.LOOP 138.0 Circuit 1" 1.000  
 line\_246 "Line HARTT 138.0 to GREENVLY 138.0 Circuit 1" 1.000  
 line\_247 "Line CIENEGA 138.0 to S.TRAIL 138.0 Circuit 1" 1.000  
 line\_248 "Line VAIL\_NOG 138.0 to VAIL 138.0 Circuit 1" 1.000  
 line\_249 "Line VAIL\_NOG 138.0 to NOGALES 138.0 Circuit 1" 1.000  
 line\_250 "Line NOGALES 138.0 to KANTOR 138.0 Circuit 1" 1.000  
 line\_251 "Line KANTOR 138.0 to CANEZ 138.0 Circuit 1" 1.000  
 line\_252 "Line CANEZ 138.0 to SONOITA 138.0 Circuit 1" 1.000  
 line\_253 "Line SONOITA 138.0 to VALNCIA 138.0 Circuit 1" 1.000  
 line\_254 "Line GATEWAY 138.0 to VALNCIA 138.0 Circuit 1" 1.000  
 line\_255 "Line COPPERVR 230.0 to FRISCO 230.0 Circuit 1" 1.000  
 line\_256 "Line PD-MORNC 230.0 to FRISCO 230.0 Circuit 1" 1.000  
 line\_257 "Line APACHE 115.0 to SNMANUEL 115.0 Circuit 1" 1.000  
 line\_258 "Line APACHE 230.0 to BUTERFLD 230.0 Circuit 1" 1.000  
 line\_259 "Line APACHE 230.0 to RED TAIL 230.0 Circuit 1" 1.000  
 line\_260 "Line APACHE 230.0 to WINCHSTR 230.0 Circuit 1" 1.000  
 line\_261 "Line AVRA 115.0 to MARANA 115.0 Circuit 1" 1.000  
 line\_262 "Line AVRA 115.0 to SNDARIO 115.0 Circuit 1" 1.000  
 line\_263 "Line BICKNELL 345.0 to VAIL 345.0 Circuit 1" 1.000  
 line\_264 "Line BICKNELL 115.0 to THREEPNT 115.0 Circuit 1" 1.000  
 line\_265 "Line BUTERFLD 230.0 to SAN RAF 230.0 Circuit 1" 1.000  
 line\_266 "Line DOSCONDO 230.0 to HACKBERY 230.0 Circuit 1" 1.000  
 line\_267 "Line MARANATP 115.0 to MARANA 115.0 Circuit 1" 1.000  
 line\_268 "Line MARANATP 115.0 to RATTLNKN 115.0 Circuit 1" 1.000  
 line\_269 "Line MORENCI 230.0 to PD-MORNC 230.0 Circuit 1" 1.000  
 line\_270 "Line MORENCI 230.0 to GREEN-SW 230.0 Circuit 1" 1.000  
 line\_271 "Line PANTANO 115.0 to KARTCHNR 115.0 Circuit 1" 1.000  
 line\_272 "Line PANTANO 230.0 to NEWTUCSN 230.0 Circuit 1" 1.000  
 line\_273 "Line RED TAIL 230.0 to DOSCONDO 230.0 Circuit 1" 1.000  
 line\_274 "Line THREEPNT 115.0 to VALEN-SW 115.0 Circuit 1" 1.000  
 line\_275 "Line THREEPNT 115.0 to SNDARIO 115.0 Circuit 1" 1.000  
 line\_276 "Line VALEN-SW 115.0 to BLACKMTN 115.0 Circuit 1" 1.000  
 line\_277 "Line HACKBERY 230.0 to MORENCI 230.0 Circuit 1" 1.000  
 line\_278 "Line SNDARIO 115.0 to BRAWLEY 115.0 Circuit 1" 1.000  
 line\_279 "Line SAHUARIT 230.0 to BICKNELL 230.0 Circuit 1" 1.000  
 line\_280 "Line S.BRKRCH 115.0 to SNMANUEL 115.0 Circuit 1" 1.000  
 line\_281 "Line NAVISKA 115.0 to ADONIS 115.0 Circuit 1" 1.000  
 line\_282 "Line SAN JOAQ 115.0 to SANXAVER 115.0 Circuit 1" 1.000  
 line\_283 "Line PICTROCK 115.0 to SANDARIO 115.0 Circuit 1" 1.000  
 line\_284 "Line ADONIS 115.0 to RATTLNKN 115.0 Circuit 1" 1.000  
 line\_285 "Line NEWTUCSN 230.0 to SAHUARIT 230.0 Circuit 1" 1.000  
 line\_286 "Line MEAD N 230.0 to HVRA3A4 230.0 Circuit 1" 1.000

line\_287 "Line MEAD S 230.0 to MEAD N 230.0 Circuit 1" 1.000  
 line\_288 "Line BLYTHE 161.0 to BUCKBLVD 161.0 Circuit 1" 1.000  
 line\_289 "Line BLYTHE 161.0 to GLT TAP 161.0 Circuit 1" 1.000  
 line\_290 "Line BLYTHE 161.0 to HEADGATE 161.0 Circuit 1" 1.000  
 line\_291 "Line BLYTHE 161.0 to BLYTHEAZ 161.0 Circuit 1" 1.000  
 line\_292 "Line DAVIS 230.0 to RIVIERA 230.0 Circuit 1" 1.000  
 line\_293 "Line DAVIS 230.0 to MEAD N 230.0 Circuit 1" 1.000  
 line\_294 "Line DAVIS 230.0 to ZORB 230.0 Circuit 1" 1.000  
 line\_295 "Line DAVIS 230.0 to TOPOCK 230.0 Circuit 2" 1.000  
 line\_296 "Line HOVRA5A6 230.0 to MEAD S 230.0 Circuit 1" 1.000  
 line\_297 "Line HOVRA7-9 230.0 to MEAD S 230.0 Circuit 1" 1.000  
 line\_298 "Line PARKER 161.0 to BLYTHE 161.0 Circuit 1" 1.000  
 line\_299 "Line PARKER 161.0 to BOUSE 161.0 Circuit 1" 1.000  
 line\_300 "Line PARKER 161.0 to HEADGATE 161.0 Circuit 1" 1.000  
 line\_301 "Line PARKER 161.0 to PARKERAZ 161.0 Circuit 1" 1.000  
 line\_302 "Line PARKER 230.0 to EAGLEYE 230.0 Circuit 1" 1.000  
 line\_303 "Line PARKER 230.0 to BLK MESA 230.0 Circuit 1" 1.000  
 line\_304 "Line PARKER 230.0 to HAVASU 230.0 Circuit 1" 1.000  
 line\_305 "Line PARKER 230.0 to HARCUVAR 230.0 Circuit 1" 1.000  
 line\_306 "Line COOLIDGE 115.0 to VLYFARMS 115.0 Circuit 1" 1.000  
 line\_307 "Line COOLIDGE 115.0 to ED-2 115.0 Circuit 1" 1.000  
 line\_308 "Line COOLIDGE 115.0 to SIGNAL 115.0 Circuit 1" 1.000  
 line\_309 "Line COOLIDGE 115.0 to COOLDGAZ 115.0 Circuit 1" 1.000  
 line\_310 "Line COOLIDGE 230.0 to SUN ARIZ 230.0 Circuit 1" 1.000  
 line\_311 "Line COOLIDGE 230.0 to SUN ARIZ 230.0 Circuit 2" 1.000  
 line\_312 "Line BOUSE 161.0 to KOFA 161.0 Circuit 1" 1.000  
 line\_313 "Line BOUSE 161.0 to BOUSE AZ 161.0 Circuit 1" 1.000  
 line\_314 "Line DEL BAC 115.0 to NOGALES 115.0 Circuit 1" 1.000  
 line\_315 "Line EMPIRE 115.0 to CASAGRND 115.0 Circuit 1" 1.000  
 line\_316 "Line GILA 161.0 to KNOB 161.0 Circuit 1" 1.000  
 line\_317 "Line GILA 161.0 to DOME TAP 161.0 Circuit 1" 1.000  
 line\_318 "Line LIBERTY 230.0 to WESTWNGW 230.0 Circuit 1" 1.000  
 line\_319 "Line LIBERTY 230.0 to TS4 230.0 Circuit 1" 1.000  
 line\_320 "Line LIBERTY 230.0 to LONE BUT 230.0 Circuit 1" 1.000  
 line\_321 "Line LIBERTY 230.0 to PHXWAPA 230.0 Circuit 1" 1.000  
 line\_322 "Line LIBERTY 345.0 to PEACOCK 345.0 Circuit 1" 1.000  
 line\_323 "Line LONE BUT 230.0 to TESTTRAK 230.0 Circuit 1" 1.000  
 line\_324 "Line LONE BUT 230.0 to SUN ARIZ 230.0 Circuit 1" 1.000  
 line\_325 "Line MCCONICO 230.0 to DAVIS 230.0 Circuit 1" 1.000  
 line\_326 "Line MCCONICO 230.0 to GRIFFITH 230.0 Circuit 1" 1.000  
 line\_327 "Line MCCONICO 230.0 to HARRIS 230.0 Circuit 1" 1.000  
 line\_328 "Line ORACLE 115.0 to S.BRKRCH 115.0 Circuit 1" 1.000  
 line\_329 "Line ORACLE 115.0 to ORACLEAZ 115.0 Circuit 1" 1.000  
 line\_330 "Line ADAMS TP 115.0 to APACHE 115.0 Circuit 1" 1.000  
 line\_331 "Line PHXWAPA 230.0 to LONE BUT 230.0 Circuit 1" 1.000  
 line\_332 "Line PINPK 230.0 to PINPKSRP 230.0 Circuit 1" 1.000  
 line\_333 "Line PINPK 230.0 to PINPKSRP 230.0 Circuit 2" 1.000  
 line\_334 "Line WLTNMOHK 161.0 to GILA 161.0 Circuit 1" 1.000

line\_335 "Line WLTNMOHK 161.0 to DOME TAP 161.0 Circuit 1" 1.000  
 line\_336 "Line TUCSON 115.0 to DEL BAC 115.0 Circuit 1" 1.000  
 line\_337 "Line TUCSON 115.0 to ORACLE 115.0 Circuit 1" 1.000  
 line\_338 "Line ED-2 115.0 to SIGNAL 115.0 Circuit 1" 1.000  
 line\_339 "Line ED-2 115.0 to ED-4 115.0 Circuit 1" 1.000  
 line\_340 "Line ED-2 115.0 to BRADY 115.0 Circuit 1" 1.000  
 line\_341 "Line ED-5 115.0 to ED-5B 115.0 Circuit 1" 1.000  
 line\_342 "Line TESTTRAK 230.0 to CASAGRND 230.0 Circuit 1" 1.000  
 line\_343 "Line ED-5B 115.0 to EMPIRE 115.0 Circuit 1" 1.000  
 line\_344 "Line ED-4 115.0 to ED-5 115.0 Circuit 1" 1.000  
 line\_345 "Line HILLTOP 230.0 to MCCONICO 230.0 Circuit 1" 1.000  
 line\_346 "Line N.HAVASU 230.0 to PARKER 230.0 Circuit 1" 1.000  
 line\_347 "Line N.HAVASU 230.0 to TOPOCK 230.0 Circuit 1" 1.000  
 line\_348 "Line HOVRN7N8 230.0 to MEAD S 230.0 Circuit 1" 1.000  
 line\_349 "Line HOVRN5N6 230.0 to MEAD S 230.0 Circuit 1" 1.000  
 line\_350 "Line HOVRN3N4 230.0 to MEAD S 230.0 Circuit 1" 1.000  
 line\_351 "Line HOVRN1N2 230.0 to MEAD S 230.0 Circuit 1" 1.000  
 line\_352 "Line HOVRA1A2 230.0 to MEAD S 230.0 Circuit 1" 1.000  
 line\_353 "Line KOFA 161.0 to DOME TAP 161.0 Circuit 1" 1.000  
 line\_354 "Line GLT TAP 161.0 to KNOB 161.0 Circuit 1" 1.000  
 line\_355 "Line PRSCOTWA 230.0 to PRESCOTT 230.0 Circuit 1" 1.000  
 line\_356 "Line PRSCOTWA 230.0 to RNDVLYTP 230.0 Circuit 1" 1.000  
 line\_357 "Line GAVLINWA 230.0 to GAVILNPK 230.0 Circuit 1" 1.000  
 line\_358 "Line GAVLINWA 230.0 to PINPK 230.0 Circuit 1" 1.000  
 line\_359 "Line GAVLINWA 230.0 to PRSCOTWA 230.0 Circuit 1" 1.000  
 line\_360 "Line RACEWYWA 230.0 to WESTWNGE 230.0 Circuit 1" 1.000  
 line\_361 "Line SLRC 230.0 to GILA 230.0 Circuit 1" 1.000  
 line\_362 "Line SLRC 230.0 to GILA 230.0 Circuit 2" 1.000  
 line\_363 "Line GILA 230.0 to NGL-E 230.0 Circuit 1" 1.000  
 line\_364 "Line GILA 230.0 to NGL-W 230.0 Circuit 1" 1.000  
 line\_365 "Line BLACKMTN 115.0 to BLKMTNAZ 115.0 Circuit 1" 1.000  
 line\_366 "Line BLACKMTN 115.0 to DEL BAC 115.0 Circuit 1" 1.000  
 line\_367 "Line BLACKMTN 115.0 to SNYDHILL 115.0 Circuit 1" 1.000  
 line\_368 "Line BRADY 115.0 to BRADYAZ 115.0 Circuit 1" 1.000  
 line\_369 "Line BRADY 115.0 to PICACHOW 115.0 Circuit 1" 1.000  
 line\_370 "Line BRAWLEY 115.0 to BRAWLYAZ 115.0 Circuit 1" 1.000  
 line\_371 "Line BRAWLEY 115.0 to SAN JOAQ 115.0 Circuit 1" 1.000  
 line\_372 "Line HARCUIVAR 230.0 to HARCUI AZ 230.0 Circuit 1" 1.000  
 line\_373 "Line HARCUIVAR 230.0 to HASSYTAP 230.0 Circuit 1" 1.000  
 line\_374 "Line N.WADDEL 230.0 to RACEWYWA 230.0 Circuit 1" 1.000  
 line\_375 "Line PICACHOW 115.0 to PICACHAZ 115.0 Circuit 1" 1.000  
 line\_376 "Line PICACHOW 115.0 to RED ROCK 115.0 Circuit 1" 1.000  
 line\_377 "Line RATTLNPK 115.0 to TUCSON 115.0 Circuit 1" 1.000  
 line\_378 "Line RATTLNPK 115.0 to TWINPEAK 115.0 Circuit 1" 1.000  
 line\_379 "Line RED ROCK 115.0 to SAG.EAST 115.0 Circuit 1" 1.000  
 line\_380 "Line RED ROCK 115.0 to REDRCKAZ 115.0 Circuit 1" 1.000  
 line\_381 "Line SANDARIO 115.0 to SANDARAZ 115.0 Circuit 1" 1.000  
 line\_382 "Line SANXAVER 115.0 to SANXAVAZ 115.0 Circuit 1" 1.000

line\_383 "Line SANXAVER 115.0 to SNYDHILL 115.0 Circuit 1" 1.000  
 line\_384 "Line SPKHILTP 230.0 to COOLIDGE 230.0 Circuit 1" 1.000  
 line\_385 "Line TWINPEAK 115.0 to TWINPKAZ 115.0 Circuit 1" 1.000  
 line\_386 "Line TWINPEAK 115.0 to PICTROCK 115.0 Circuit 1" 1.000  
 line\_387 "Line ZORB 230.0 to TOPOCK 230.0 Circuit 1" 1.000  
 line\_388 "Line GRIFFITH 230.0 to PEACOCK 230.0 Circuit 1" 1.000  
 line\_389 "Line PEACOCK 230.0 to HILLTOP 230.0 Circuit 1" 1.000  
 line\_390 "Line PEACOCK 345.0 to MEAD 345.0 Circuit 1" 1.000  
 line\_391 "Line TOPOCK 230.0 to BLK MESA 230.0 Circuit 1" 1.000  
 line\_392 "Line TOPOCK 230.0 to SOPOINT 230.0 Circuit 1" 1.000  
 line\_393 "Line TOPOCK 230.0 to SOPOINT 230.0 Circuit 2" 1.000  
 line\_394 "Line HASSYTAP 230.0 to HASSY AZ 230.0 Circuit 1" 1.000  
 line\_395 "Line HASSYTAP 230.0 to LIBERTY 230.0 Circuit 1" 1.000  
 line\_396 "Line RNDVLYTP 230.0 to ROUNDVLY 230.0 Circuit 1" 1.000  
 line\_397 "Line RNDVLYTP 230.0 to PEACOCK 230.0 Circuit 1" 1.000  
 line\_398 "Line ROGSWAPA 230.0 to PINPK 230.0 Circuit 1" 1.000  
 line\_399 "Line ROGSWAPA 230.0 to PINPK 230.0 Circuit 2" 1.000  
 line\_400 "Line ROGSWAPA 230.0 to SPKHILTP 230.0 Circuit 1" 1.000  
 line\_401 "Line HOGBAKTP 115.0 to HOGBAK 115.0 Circuit 1" 1.000  
 line\_402 "Line FLAGSTAF 345.0 to GLENCANY 345.0 Circuit 1" 1.000  
 line\_403 "Line FLAGSTAF 345.0 to GLENCANY 345.0 Circuit 2" 1.000  
 line\_404 "Line FLAGSTAF 345.0 to PINPKBRB 345.0 Circuit 1" 1.000  
 line\_405 "Line FLAGSTAF 345.0 to PINPKBRB 345.0 Circuit 2" 1.000  
 line\_406 "Line GALLEGOS 115.0 to BERGIN 115.0 Circuit 1" 1.000  
 line\_407 "Line GLEN PS 230.0 to NAVAJO 230.0 Circuit 1" 1.000  
 line\_408 "Line KAYENTA 230.0 to SHIPROCK 230.0 Circuit 1" 1.000  
 line\_409 "Line KAYENTA 230.0 to LNGHOUSE 230.0 Circuit 1" 1.000  
 line\_410 "Line SHIPROCK 115.0 to FRUITAP 115.0 Circuit 1" 1.000  
 line\_411 "Line SHIPROCK 115.0 to MESA FM 115.0 Circuit 1" 1.000  
 line\_412 "Line SHIPROCK 345.0 to FOURCORN 345.0 Circuit 1" 1.000  
 line\_413 "Line NAVAJO 230.0 to LNGHOUSE 230.0 Circuit 1" 1.000  
 line\_414 "Line ANIMAS 115.0 to MESA FM 115.0 Circuit 1" 1.000  
 line\_415 "Line ANIMAS 115.0 to SULLIVAN 115.0 Circuit 1" 1.000  
 line\_416 "Line BERGIN 115.0 to FOOTHILS 115.0 Circuit 1" 1.000  
 line\_417 "Line FOOTHILS 115.0 to HOODMESA 115.0 Circuit 1" 1.000  
 line\_418 "Line FRUITAP 115.0 to FRUITLND 115.0 Circuit 1" 1.000  
 line\_419 "Line FRUITAP 115.0 to HOODMESA 115.0 Circuit 1" 1.000  
 line\_420 "Line GLADETAP 115.0 to HOODMESA 115.0 Circuit 1" 1.000  
 line\_421 "Line GLADETAP 115.0 to LAPLATA 115.0 Circuit 1" 1.000  
 line\_422 "Line HOODMESA 115.0 to SULLIVAN 115.0 Circuit 1" 1.000  
 line\_423 "Line NAVAJO 115.0 to SAN JUAN 115.0 Circuit 1" 1.000  
 line\_424 "Line ADAMS TP 115.0 to NOGALES 115.0 Circuit 1" 1.000  
 line\_425 "Line PINALWES 345.0 to 3PTS345 345.0 Circuit 1" 1.000  
 line\_426 "Line TORTOLIT 345.0 to NLOOP345 345.0 Circuit 1" 1.000  
 line\_427 "Line 3PTS345 345.0 to SOUTH 345.0 Circuit 1" 1.000  
 line\_428 "Line DMP 138.0 to ANKLAM 138.0 Circuit 1" 1.000  
 line\_429 "Line MIDVALE 138.0 to RAYTHEON 138.0 Circuit 1" 1.000  
 line\_430 "Line N. LOOP 138.0 to RANVISTO 138.0 Circuit 1" 1.000

line\_431 "Line N. LOOP 138.0 to RANVISTO 138.0 Circuit 1A" 1.000  
 line\_432 "Line SN.CRUIZ 138.0 to ANKLAM 138.0 Circuit 1" 1.000  
 line\_433 "Line SOUTH 138.0 to SPNCER 138.0 Circuit 1" 1.000  
 line\_434 "Line SOUTH 138.0 to MEDINA 138.0 Circuit 1" 1.000  
 line\_435 "Line SOUTH 138.0 to RAYTHEON 138.0 Circuit 1" 1.000  
 line\_436 "Line TORTOLIT 138.0 to N. LOOP 138.0 Circuit 1A" 1.000  
 line\_437 "Line TORTOLIT 138.0 to N. LOOP 138.0 Circuit 2A" 1.000  
 line\_438 "Line TORTOLIT 138.0 to N. LOOP 138.0 Circuit 3" 1.000  
 line\_439 "Line TORTOLIT 138.0 to N. LOOP 138.0 Circuit 4" 1.000  
 line\_440 "Line TORTOLIT 138.0 to RANVISTO 138.0 Circuit 1A" 1.000  
 line\_441 "Line RBWILMOT 138.0 to IRVNGTN 138.0 Circuit 1" 1.000  
 line\_442 "Line TECHPARK 138.0 to VAIL 138.0 Circuit 1" 1.000  
 line\_443 "Line SPNCER 138.0 to MEDINA 138.0 Circuit 1" 1.000  
 line\_444 "Line ORNGROVE 138.0 to LACANADA 138.0 Circuit 1" 1.000  
 line\_445 "Line ORNGROVE 138.0 to RILLITO 138.0 Circuit 1" 1.000  
 line\_446 "Line ORNGROVE 138.0 to EASTINA 138.0 Circuit 1" 1.000  
 line\_447 "Line THRNDAL 138.0 to N. LOOP 138.0 Circuit 1" 1.000  
 line\_448 "Line THRNDAL 138.0 to MARANA 138.0 Circuit 1" 1.000  
 line\_449 "Line UA MED 138.0 to TUCSON 138.0 Circuit 1" 1.000  
 line\_450 "Line UA MED 138.0 to KINO 138.0 Circuit 1" 1.000  
 line\_451 "Line RAYTHEON 138.0 to MEDINA 138.0 Circuit 1" 1.000  
 line\_452 "Line KANTOR 138.0 to TUBAC 138.0 Circuit 1" 1.000  
 line\_453 "Line TUBAC 138.0 to CANEZ 138.0 Circuit 1" 1.000  
 line\_454 "Line PERKINPS 500.0 to WESTWING 500.0 Circuit 1" 1.000  
 line\_455 "Line BROWNING 230.0 to RANDOLPH 230.0 Circuit 1" 1.000  
 line\_456 "Line ABEL 230.0 to SCHRADER 230.0 Circuit 1" 1.000  
 line\_457 "Line ABEL 230.0 to RS-24 230.0 Circuit 1" 1.000  
 line\_458 "Line ABEL 230.0 to RS-24 230.0 Circuit 2" 1.000  
 line\_459 "Line ABEL 230.0 to RANDOLPH 230.0 Circuit 1" 1.000  
 line\_460 "Line PINAL\_C 230.0 to RANDOLPH 230.0 Circuit 1" 1.000  
 line\_461 "Line MEAD 500.0 to PERKINS 500.0 Circuit 1" 1.000  
 line\_462 "Line BUTERFLD 230.0 to PANTANO 230.0 Circuit 1" 1.000  
 line\_463 "Line SANDARIO 115.0 to SNDARIO 115.0 Circuit 1" 1.000  
 line\_464 "Line HIDALGO 345.0 to GREENLEE 345.0 Circuit 1" 1.000  
 line\_465 "Line SPRINGR 345.0 to LUNA 345.0 Circuit 1" 1.000  
 line\_466 "Line MEAD S 230.0 to EQUEST 230.0 Circuit 1" 1.000  
 line\_467 "Line MEAD N 230.0 to EQUEST 230.0 Circuit 2" 1.000  
 line\_468 "Line MEAD N 230.0 to NEWPORT 230.0 Circuit 1" 1.000  
 line\_469 "Line MEAD N 230.0 to EASTSIDE 230.0 Circuit 1" 1.000  
 line\_470 "Line MOENKOPI 500.0 to MARKETPL 500.0 Circuit 1" 1.000  
 line\_471 "Line NAVAJO 500.0 to CRYSTAL 500.0 Circuit 1" 1.000  
 line\_472 "Line FOURCORN 345.0 to RIOPUER 345.0 Circuit 1" 1.000  
 line\_473 "Line FOURCORN 345.0 to SAN\_JUAN 345.0 Circuit 1" 1.000  
 line\_474 "Line FOURCORN 345.0 to WESTMESA 345.0 Circuit 1" 1.000  
 line\_475 "Line FOURCORN 230.0 to PILLAR 230.0 Circuit 1" 1.000  
 line\_476 "Line HENDRSON 230.0 to MEAD N 230.0 Circuit 1" 1.000  
 line\_477 "Line H ALLEN 500.0 to MEAD 500.0 Circuit 1" 1.000  
 line\_478 "Line BC TAP 230.0 to MEAD N 230.0 Circuit 1" 1.000

line\_479 "Line DAVIS 230.0 to MCCULLGH 230.0 Circuit 1" 1.000  
 line\_480 "Line MEAD N 230.0 to DECATUR 230.0 Circuit 1" 1.000  
 line\_481 "Line MEAD S 230.0 to PAHRUMP 230.0 Circuit 1" 1.000  
 line\_482 "Line MEAD S 230.0 to GREENWAY 230.0 Circuit 1" 1.000  
 line\_483 "Line MEAD S 230.0 to MCCULLGH 230.0 Circuit 1" 1.000  
 line\_484 "Line MEAD S 230.0 to MCCULLGH 230.0 Circuit 2" 1.000  
 line\_485 "Line MEAD 500.0 to MARKETPL 500.0 Circuit 1" 1.000  
 line\_486 "Line PINTO PS 345.0 to FOURCORN 345.0 Circuit 1" 1.000  
 line\_487 "Line SIGURDPS 230.0 to GLENCANY 230.0 Circuit 1" 1.000  
 line\_488 "Line SHIPROCK 345.0 to SAN\_JUAN 345.0 Circuit 1" 1.000  
 line\_489 "Line SAN\_JUAN 345.0 to MCKINLEY 345.0 Circuit 1" 1.000  
 line\_490 "Line SAN\_JUAN 345.0 to MCKINLEY 345.0 Circuit 2" 1.000  
 line\_491 "Line BLYTHE 161.0 to NILAND 161.0 Circuit 1" 1.000  
 line\_492 "Line KNOB 161.0 to PILOTKNB 161.0 Circuit 1" 1.000  
 line\_493 "Line HASSYAMP 500.0 to N.GILA 500.0 Circuit 1" 1.000  
 line\_494 "Line MOENKOPI 500.0 to ELDORDO 500.0 Circuit 1" 1.000  
 line\_495 "Line MEAD S 230.0 to ELDORDO 230.0 Circuit 1" 1.000  
 line\_496 "Line MEAD S 230.0 to ELDORDO 230.0 Circuit 2" 1.000  
 line\_497 "Line PARKER 230.0 to GENE 230.0 Circuit 1" 1.000  
 line\_498 "Line BLYTHE 161.0 to BLYTHESC 161.0 Circuit 1" 1.000  
 line\_499 "Line CAMINO 230.0 to MEAD S 230.0 Circuit E" 1.000  
 line\_500 "Line CAMINO 230.0 to MEAD S 230.0 Circuit W" 1.000  
 line\_501 "Line HASSYAMP 500.0 to N.GILA 500.0 Circuit 2" 1.000  
 line\_502 "Line EQUEST N 500.0 to MEAD 500.0 Circuit 1" 1.000  
 line\_503 "Line MEAD N 230.0 to ARDEN 230.0 Circuit 1" 1.000  
 line\_504 "Line MEAD N 230.0 to SINATRA 230.0 Circuit 1" 1.000  
 line\_505 "Line MEAD S 230.0 to DIAMOND 230.0 Circuit 1" 1.000  
 line\_506 "Line MEAD S 230.0 to DIAMOND 230.0 Circuit 2" 1.000  
 line\_507 "Line PALOVRDE 500.0 to COLRIVER 500.0 Circuit 1" 1.000  
 line\_508 "Line SHIPROCK 230.0 to BLKGLADE 230.0 Circuit 1" 1.000  
 line\_509 "Line GLADETAP 115.0 to BLKGLADS 115.0 Circuit 1" 1.000  
 line\_510 "Line CACTUS 230.0 to PPAPS N 230.0 Circuit 1" 1.000  
 line\_511 "Line LONEPEAK 230.0 to PPAPS E 230.0 Circuit 1" 1.000  
 line\_512 "Line REACH 230.0 to PPAPS C 230.0 Circuit 1" 1.000  
 line\_513 "Line PPAPS W 230.0 to PPAPS C 230.0 Circuit 1" 1.000  
 line\_514 "Line PPAPS C 230.0 to PPAPS E 230.0 Circuit 1" 1.000  
 line\_515 "Line PPAPS N 230.0 to OCOTILLO 230.0 Circuit 1" 1.000  
 line\_516 "Line PPAPS N 230.0 to PPAPS E 230.0 Circuit 1" 1.000  
 line\_517 "Line PPAPS N 230.0 to PINPKSRP 230.0 Circuit 1" 1.000  
 line\_518 "Line PPAPS N 230.0 to PINPKSRP 230.0 Circuit 2" 1.000  
 line\_519 "Line PALOVRDE 500.0 to DELANY 500.0 Circuit 1" 1.000  
 line\_520 "Line SUN ARIZ 230.0 to PINAL\_C 230.0 Circuit 1" 1.000  
 line\_521 "Line CHOLLA 345.0 to MAZATZAL 345.0 Circuit 1" 1.000  
 line\_522 "Line N.GILA 230.0 to TS8 230.0 Circuit 1" 1.000  
 line\_523 "Line TORTOLIT 138.0 to NARANJA 138.0 Circuit 1" 1.000  
 line\_524 "Line TURLY\_S 115.0 to BLANCO 115.0 Circuit 1" 1.000  
 line\_525 "Line TURLY\_S 115.0 to SAN JUAN 115.0 Circuit 1" 1.000  
 line\_526 "Line BERGIN 115.0 to TURLY\_S 115.0 Circuit 1" 1.000

line\_527 "Line PRESCOTT 115.0 to BAGCAP 115.0 Circuit 1" 1.000  
 line\_528 "Line BAGCAP 115.0 to BAGDAD 115.0 Circuit 1" 1.000  
 line\_529 "Line EAGLEYE 230.0 to BUCKEYE2 230.0 Circuit 1" 1.000  
 line\_530 "Line BUCKEYE2 230.0 to LIBERTY 230.0 Circuit 1" 1.000  
 line\_531 "Line Q044 230.0 to GILARIVR 230.0 Circuit 1" 1.000  
 line\_532 "Line TS12 230.0 to SAGUARO 230.0 Circuit 1" 1.000  
 line\_533 "Line MILLIGAN 230.0 to TS12 230.0 Circuit 1" 1.000  
 line\_534 "Line BOUSE 161.0 to BLACK PK 161.0 Circuit 1" 1.000  
 line\_535 "Line BUCKEYE 230.0 to LIBERTY 230.0 Circuit 1" 1.000  
 line\_536 "Line HASSYAMP 500.0 to HDWSH 500.0 Circuit 1" 1.000  
 line\_537 "Line HDWSH 500.0 to N.GILA 500.0 Circuit 1" 1.000  
 line\_538 "Line Q043B2 500.0 to HDWSH 500.0 Circuit 1" 1.000  
 line\_539 "Line Q043B1 500.0 to HDWSH 500.0 Circuit 1" 1.000  
 line\_540 "Line SANTAN 230.0 to RS-24 230.0 Circuit 1" 1.000  
 line\_541 "Line SCHRADER 230.0 to RS-24 230.0 Circuit 1" 1.000  
 line\_542 "Line PAPAGOBT 230.0 to KYR-NEW 230.0 Circuit 1" 1.000  
 line\_543 "Line SNTAROSA 230.0 to DBG 230.0 Circuit 1" 1.000  
 line\_544 "Line KYRENE 500.0 to BROWNING 500.0 Circuit 1" 1.000  
 line\_545 "Line PERK PS2 500.0 to PERKINPS 500.0 Circuit 1" 1.000  
 line\_546 "Line PERKINPS 500.0 to PERK PS1 500.0 Circuit 1" 1.000  
 line\_547 "Line PERKINS 500.0 to PERKINPS 500.0 Circuit 1" 1.000  
 line\_548 "Line BROWNING 500.0 to SILVERKG 500.0 Circuit 1" 1.000  
 line\_549 "Line PINAL\_C 500.0 to SNTAROSA 500.0 Circuit 1" 1.000  
 line\_550 "Line PINAL\_C 500.0 to TORTOLIT 500.0 Circuit 1" 1.000  
 line\_551 "Line PINAL\_W 500.0 to SNTAROSA 500.0 Circuit 1" 1.000  
 line\_552 "Line HASSYAMP 500.0 to MESQUIT2 500.0 Circuit 2" 1.000  
 line\_553 "Line ASARCOSR 115.0 to ASARCOTP 115.0 Circuit 1" 1.000  
 line\_554 "Line ASARCOTP 115.0 to HAYDENAZ 115.0 Circuit 1" 1.000  
 line\_555 "Line ASARCOTP 115.0 to CRUSHER 115.0 Circuit 1" 1.000  
 line\_556 "Line BONNEYTP 115.0 to CRUSHER 115.0 Circuit 1" 1.000  
 line\_557 "Line CARLOTA 115.0 to PINTOVLY 115.0 Circuit 1" 1.000  
 line\_558 "Line CARLOTA 115.0 to SILVERK2 115.0 Circuit 1" 1.000  
 line\_559 "Line FRAZIER 115.0 to HORMESA 115.0 Circuit 1" 1.000  
 line\_560 "Line GOLDFELD 115.0 to 461E5.1N 115.0 Circuit 1" 1.000  
 line\_561 "Line GASCLEAN 115.0 to 843E2.7N 115.0 Circuit 1" 1.000  
 line\_562 "Line KEARNY 115.0 to KEARNYTP 115.0 Circuit 1" 1.000  
 line\_563 "Line MIAMI 115.0 to MIAMI 3 115.0 Circuit 1" 1.000  
 line\_564 "Line OAKFLAT 115.0 to TRASK 115.0 Circuit 1" 1.000  
 line\_565 "Line SILVERK2 115.0 to PINTOVLY 115.0 Circuit 1" 1.000  
 line\_566 "Line SUPERIOR 115.0 to TRASK 115.0 Circuit 1" 1.000  
 line\_567 "Line CARREL 115.0 to GOLDFELD 115.0 Circuit 1" 1.000  
 line\_568 "Line CARREL 115.0 to SPURLOCK 115.0 Circuit 1" 1.000  
 line\_569 "Line MIAMI 4 115.0 to 843E2.7N 115.0 Circuit 1" 1.000  
 line\_570 "Line MIAMI 3 115.0 to PINAL 115.0 Circuit 1" 1.000  
 line\_571 "Line MIAMI 3 115.0 to MIAMI 4 115.0 Circuit 1" 1.000  
 line\_572 "Line 461E5.1N 115.0 to MRMNFLAT 115.0 Circuit 1" 1.000  
 line\_573 "Line 461E5.1N 115.0 to STEWMTN1 115.0 Circuit 1" 1.000  
 line\_574 "Line MESQUITE 230.0 to MESQUI S 230.0 Circuit 1" 1.000

line\_575 "Line MESQUITE 230.0 to MESQUI S 230.0 Circuit 2" 1.000  
 line\_576 "Line ANDERSON 230.0 to KYR-NEW 230.0 Circuit 1" 1.000  
 line\_577 "Line ORME 230.0 to ANDERSON 230.0 Circuit 1" 1.000  
 line\_578 "Line BROWNING 230.0 to DINOSAUR 230.0 Circuit 1" 1.000  
 line\_579 "Line PINAL\_C 230.0 to DBG 230.0 Circuit 1" 1.000  
 line\_580 "Line DBG 230.0 to CASGRAPS 230.0 Circuit 1" 1.000  
 line\_581 "Line LIBERTY 230.0 to RUDD 230.0 Circuit 1" 1.000  
 tran\_582 "Tran CHOLLA 500.00 to CHOLLA 345.00 Circuit 1CHOLLA3T 34.50" 1.000  
 tran\_583 "Tran CHOLLA 500.00 to CHOLLA 345.00 Circuit 2CHOLLA6T 34.50" 1.000  
 tran\_584 "Tran FOURCORN 500.00 to FOURCORN 345.00 Circuit 14C 1AA T 13.80" 1.000  
 tran\_585 "Tran SAGUARO 500.00 to SAG.EAST 115.00 Circuit 1SAGUAR7T 34.50" 1.000  
 tran\_586 "Tran SAGUARO 500.00 to SAG.WEST 115.00 Circuit 1SAGUAR4T 34.50" 1.000  
 tran\_587 "Tran WESTWING 500.00 to WESTWNGW 230.00 Circuit 2WESTWG 4 34.50" 1.000  
 tran\_588 "Tran WESTWING 500.00 to WESTWNGW 230.00 Circuit 3WESTWG10 34.50" 1.000  
 tran\_589 "Tran WESTWING 500.00 to WESTWNGE 230.00 Circuit 1WESTWG 1 34.50" 1.000  
 tran\_590 "Tran WESTWING 500.00 to WESTWING 345.00 Circuit 1 0.00" 1.000  
 tran\_591 "Tran YAVAPAI 500.00 to YAVAPAI 230.00 Circuit 1YAVAP 1T 12.47" 1.000  
 tran\_592 "Tran YAVAPAI 500.00 to YAVAPAI 230.00 Circuit 2YAVAP 3T 12.47" 1.000  
 tran\_593 "Tran GILARIVR 500.00 to GILARIVR 230.00 Circuit 1 0.00" 1.000  
 tran\_594 "Tran SNVLY 500.00 to SNVLY 230.00 Circuit 1SNVLYT1T 12.47" 1.000  
 tran\_595 "Tran SNVLY 500.00 to SNVLY 230.00 Circuit 2SNVLYT2T 12.47" 1.000  
 tran\_596 "Tran MORGAN 500.00 to RACEWAY 230.00 Circuit 1MOR1 34.50" 1.000  
 tran\_597 "Tran MORGAN 500.00 to RACEWAY 230.00 Circuit 2MOR2 34.50" 1.000  
 tran\_598 "Tran PNPKAPS 500.00 to PPAPS W 230.00 Circuit 1PP W 34.50" 1.000  
 tran\_599 "Tran CHOLLA 345.00 to CHOLLA 230.00 Circuit 1CHOLLA7T 12.50" 1.000  
 tran\_600 "Tran CHOLLA 345.00 to CHOLLA 230.00 Circuit 2 0.00" 1.000  
 tran\_601 "Tran FOURCORN 345.00 to FOURCORN 230.00 Circuit 1FOURCN4T 14.40" 1.000  
 tran\_602 "Tran FOURCORN 345.00 to FOURCORN 230.00 Circuit 2FOURCN8T 14.40" 1.000  
 tran\_603 "Tran PRESCOTT 230.00 to PRESCOTT 115.00 Circuit 1PRESCT1T 12.50" 1.000  
 tran\_604 "Tran PRESCOTT 230.00 to PRESCOTT 115.00 Circuit 2PRESCT2T 12.50" 1.000  
 tran\_605 "Tran SAGUARO 230.00 to SAG.EAST 115.00 Circuit 1SAG 10T 12.50" 1.000  
 tran\_606 "Tran SAGUARO 230.00 to SAG.WEST 115.00 Circuit 1SAG 1T 12.50" 1.000  
 tran\_607 "Tran CORONADO 500.00 to CORONADO 345.00 Circuit 1 0.00" 1.000  
 tran\_608 "Tran CORONADO 500.00 to CORONADO 345.00 Circuit 2 0.00" 1.000  
 tran\_609 "Tran KYRENE 500.00 to KYRENE 230.00 Circuit 7KYRENE7 34.50" 1.000  
 tran\_610 "Tran KYRENE 500.00 to KYRENE 230.00 Circuit 8KYRENE8 34.50" 1.000  
 tran\_611 "Tran SILVERKG 500.00 to SILVERKG 230.00 Circuit 1SILVERKG 34.50" 1.000  
 tran\_612 "Tran BROWNING 500.00 to BROWNING 230.00 Circuit 1BROWNIN1 12.47" 1.000  
 tran\_613 "Tran BROWNING 500.00 to BROWNING 230.00 Circuit 2BROWNIN2 12.47" 1.000  
 tran\_614 "Tran RUDD 500.00 to RUDD 230.00 Circuit 1RUDD1 12.47" 1.000  
 tran\_615 "Tran RUDD 500.00 to RUDD 230.00 Circuit 2RUDD2 12.47" 1.000  
 tran\_616 "Tran RUDD 500.00 to RUDD 230.00 Circuit 3RUDD3 12.47" 1.000  
 tran\_617 "Tran RUDD 500.00 to RUDD 230.00 Circuit 4 0.00" 1.000  
 tran\_618 "Tran ABEL 500.00 to ABEL 230.00 Circuit 1 0.00" 1.000  
 tran\_619 "Tran ABEL 500.00 to ABEL 230.00 Circuit 2 0.00" 1.000  
 tran\_620 "Tran PINAL\_W 500.00 to PINALWES 345.00 Circuit 1 0.00" 1.000  
 tran\_621 "Tran MESQUITE 500.00 to MESQUITE 230.00 Circuit 1 0.00" 1.000  
 tran\_622 "Tran GOLDFELD 230.00 to GOLDFELD 115.00 Circuit 1 0.00" 1.000

tran_623	"Tran GOLDFELD 230.00 to GOLDFELD 115.00 Circuit 2	0.00"	1.000
tran_624	"Tran SILVERKG 230.00 to SILVERK1 115.00 Circuit 1	0.00"	1.000
tran_625	"Tran SILVERKG 230.00 to SILVERK2 115.00 Circuit 1	0.00"	1.000
tran_626	"Tran SOUTH 345.00 to SOUTH 138.00 Circuit 1SOUTH2	13.80"	1.000
tran_627	"Tran SOUTH 345.00 to SOUTH 138.00 Circuit 2SOUTH2	13.80"	1.000
tran_628	"Tran VAIL2 345.00 to VAIL 138.00 Circuit 1	0.00"	1.000
tran_629	"Tran WINCHSTR 345.00 to WINCHSTR 230.00 Circuit 1	0.00"	1.000
tran_630	"Tran TORTOLIT 138.00 to SAG.EAST 115.00 Circuit 1	0.00"	1.000
tran_631	"Tran TORTOLIT 138.00 to SAG.WEST 115.00 Circuit 1	0.00"	1.000
tran_632	"Tran TORTOLIT 138.00 to TORTOLIT 500.00 Circuit 1	0.00"	1.000
tran_633	"Tran TORTOLIT 138.00 to TORTOLIT 500.00 Circuit 2	0.00"	1.000
tran_634	"Tran TORTOLIT 138.00 to TORTOLIT 500.00 Circuit 3	0.00"	1.000
tran_635	"Tran TORTOLIT 138.00 to TORTOLIT2 500.00 Circuit 1	0.00"	1.000
tran_636	"Tran IRVMID3 138.00 to IRVNGTN 138.00 Circuit 1	0.00"	1.000
tran_637	"Tran IRVMID4 138.00 to IRVNGTN 138.00 Circuit 1	0.00"	1.000
tran_638	"Tran GATEWAY 138.00 to GATEWAY 345.00 Circuit 1	0.00"	1.000
tran_639	"Tran COPPERVR 345.00 to COPPERVR 230.00 Circuit 1	0.00"	1.000
tran_640	"Tran COPPERVR 345.00 to COPPERVR 230.00 Circuit 2	0.00"	1.000
tran_641	"Tran APACHE 230.00 to APACHE 115.00 Circuit 1	0.00"	1.000
tran_642	"Tran APACHE 230.00 to APACHE 115.00 Circuit 2	0.00"	1.000
tran_643	"Tran BICKNELL 230.00 to BICKNELL 115.00 Circuit 1	0.00"	1.000
tran_644	"Tran BICKNELL 230.00 to BICKNELL 115.00 Circuit 2	0.00"	1.000
tran_645	"Tran BICKNELL 345.00 to BICKNELL 230.00 Circuit 1	0.00"	1.000
tran_646	"Tran GREEN-SW 345.00 to GREEN-SW 230.00 Circuit 1	0.00"	1.000
tran_647	"Tran GREEN-SW 345.00 to GREEN-SW 230.00 Circuit 2	0.00"	1.000
tran_648	"Tran PANTANO 230.00 to PANTANO 115.00 Circuit 1	0.00"	1.000
tran_649	"Tran MEAD 345.00 to MEAD N 230.00 Circuit 1	0.00"	1.000
tran_650	"Tran MEAD 500.00 to MEAD N 230.00 Circuit 1	0.00"	1.000
tran_651	"Tran MEAD 500.00 to MEAD N 230.00 Circuit 2	0.00"	1.000
tran_652	"Tran PARKER 161.00 to PARKER 230.00 Circuit 1	0.00"	1.000
tran_653	"Tran PARKER 161.00 to PARKER 230.00 Circuit 2	0.00"	1.000
tran_654	"Tran COOLIDGE 230.00 to COOLIDGE 115.00 Circuit 1	0.00"	1.000
tran_655	"Tran COOLIDGE 230.00 to COOLIDGE 115.00 Circuit 2	0.00"	1.000
tran_656	"Tran GILA 161.00 to GILA 230.00 Circuit 1	0.00"	1.000
tran_657	"Tran LIBERTY 345.00 to LIBTYPHS 230.00 Circuit 1	0.00"	1.000
tran_658	"Tran LIBTYPHS 230.00 to LIBERTY 230.00 Circuit 1	0.00"	1.000
tran_659	"Tran CASAGRND 230.00 to CASAGRND 115.00 Circuit 1	0.00"	1.000
tran_660	"Tran PEACOCK 345.00 to PEACOCK 230.00 Circuit 1	0.00"	1.000
tran_661	"Tran GLEN PS 230.00 to GLENCANY 230.00 Circuit 1	0.00"	1.000
tran_662	"Tran GLENCANY 345.00 to GLENCANY 230.00 Circuit 1	0.00"	1.000
tran_663	"Tran GLENCANY 345.00 to GLENCANY 230.00 Circuit 2	0.00"	1.000
tran_664	"Tran PINPKBRB 345.00 to PINPK 230.00 Circuit 1	0.00"	1.000
tran_665	"Tran PINPKBRB 345.00 to PINPK 230.00 Circuit 2	0.00"	1.000
tran_666	"Tran PINPKBRB 345.00 to PINPK 230.00 Circuit 3	0.00"	1.000
tran_667	"Tran SHIPROCK 230.00 to SHIPROCK 115.00 Circuit 1	0.00"	1.000
tran_668	"Tran SHIPROCK 345.00 to SHIPROCK 230.00 Circuit 1	0.00"	1.000
tran_669	"Tran TORTOLIT 500.00 to TORTOLIT 345.00 Circuit 1	0.00"	1.000
tran_670	"Tran VAIL 345.00 to VAIL 138.00 Circuit 2VAIL	13.80"	1.000

tran\_671 "Tran VAIL 345.00 to VAIL\_NOG 138.00 Circuit 1 VAIL 13.80" 1.000  
 tran\_672 "Tran VAIL2 345.00 to VAIL 138.00 Circuit 2 0.00" 1.000  
 tran\_673 "Tran TORTOLIT 138.00 to TORTOLIT 500.00 Circuit 4 0.00" 1.000  
 tran\_674 "Tran KYRENE 500.00 to KYR-NEW 230.00 Circuit 6 KYRENE6 34.50" 1.000  
 tran\_675 "Tran PINAL\_C 500.00 to PINAL\_C 230.00 Circuit 1 0.00" 1.000  
 tran\_676 "Tran PINAL\_C 500.00 to PINAL\_C 230.00 Circuit 2 0.00" 1.000  
 tran\_677 "Tran GALLEGOS 230.00 to GALLEGOS 115.00 Circuit 1 0.00" 1.000  
 tran\_678 "Tran MEAD S 230.00 to MEAD 287.00 Circuit 1 0.00" 1.000  
 tran\_679 "Tran MCKINLEY 345.00 to YAHTAHEY 115.00 Circuit 1 0.00" 1.000  
 tran\_680 "Tran SHIP PS 230.00 to SHIPROCK 230.00 Circuit 1 0.00" 1.000  
 tran\_681 "Tran SAN\_JUAN 230.00 to HOGBAK 115.00 Circuit 1 0.00" 1.000  
 tran\_682 "Tran MCKINLEY 345.00 to YAHTAHEY 115.00 Circuit 2 0.00" 1.000  
 tran\_683 "Tran NGL-E 230.00 to N.GILA 500.00 Circuit 1 0.00" 1.000  
 tran\_684 "Tran NGL-W 230.00 to N.GILA 500.00 Circuit 1 0.00" 1.000  
 tran\_685 "Tran PNP KAPS 500.00 to PPAPS E 230.00 Circuit 1 PP E 34.50" 1.000  
 tran\_686 "Tran PNP KAPS 500.00 to PPAPS N 230.00 Circuit 1 PP N 34.50" 1.000  
 tran\_687 "Tran PNP KAPS 345.00 to PPAPS C 230.00 Circuit 1 PNP K 7T 14.40" 1.000  
 tran\_688 "Tran PNP KAPS 345.00 to PPAPS E 230.00 Circuit 3 PNP K T14 14.40" 1.000  
 tran\_689 "Tran PNP KAPS 345.00 to PPAPS N 230.00 Circuit 2 PNP K T4 14.40" 1.000  
 tran\_690 "Tran N.GILA 500.00 to N.GILA 230.00 Circuit 1 0.00" 1.000  
 tran\_691 "Tran SNMANUEL 115.00 to SNMANUEL 100.00 Circuit 1 0.00" 1.000  
 tran\_692 "Tran PERKINS 500.00 to PERK PS1 500.00 Circuit 1 0.00" 1.000  
 tran\_693 "Tran PERKINS 500.00 to PERK PS2 500.00 Circuit 1 0.00" 1.000  
 tran\_694 "Tran RUDD 500.00 to RUDD 230.00 Circuit 3 ARUDD 3a 34.50" 1.000  
 tran\_695 "Tran SNTAROSA 500.00 to TESTTRAK 230.00 Circuit 1 0.00" 1.000  
 tran\_696 "Tran MESQUIT2 500.00 to MESQUITE 230.00 Circuit 2 0.00" 1.000

## Appendix D – Power Flow Result

The following table is shown to indicate there were overloaded facilities in the case, however none of the facilities below are owned by SRP.

OVERLOADED ELEMENT	RATING	ACTUAL FLOW	PERCENT OVERLOAD	OUTAGE ELEMENT
TWNTYSEC to E. LOOP 138kV LINE	941.33	951.73	101.1%	DMP to NE.LOOP 138.0 kV LINE
TWNTYSEC to E. LOOP 138kV LINE	941.33	1030.02	109.4%	E. LOOP to PANTANO 138.0kV LINE
TWNTYSEC to E. LOOP 138kV LINE	941.33	1105.53	117.4%	IRVNGTN to KINO 138.0 kV LINE
TWNTYSEC to E. LOOP 138kV LINE	941.33	1063.85	113.0%	VAIL to CIENEGA 138.0 kV LINE
TWNTYSEC to E. LOOP 138kV LINE	941.33	1219.32	129.5%	LOSREALS to VAIL 138.0kV LINE
TWNTYSEC to E. LOOP 138kV LINE	941.33	1089.76	115.8%	PANTANO to LOSREALS 138.0 kV LINE
TWNTYSEC to E. LOOP 138kV LINE	941.33	970.79	103.1%	CIENEGA to S.TRAIL 138.0kV LINE
YAVAPAI 500/230kV TRANSFORMER 2	336	357.21	106.3%	YAVAPAI 500/230kV TRANSFORMER 1
YAVAPAI 500/230kV TRANSFORMER 1	336	357.44	106.4%	YAVAPAI 500/230kV TRANSFORMER 2
PRESCOTT 230/115kV TRANSFORMER 2	83.31	88.91	107.3%	PRESCOTT 230/115kV TRANSFORMER 1
PRESCOTT 230/115kV TRANSFORMER 1	83.31	88.91	107.3%	PRESCOTT 230/115kV TRANSFORMER 2
GLENCANYON 345/230kV TRANSFORMER 2	300.00	336.91	113.8%	GLENCANYON 345/230kV TRANSFORMER 1
GLENCANYON 345/230kV TRANSFORMER 1	300.00	336.9	113.8%	GLENCANYON 345/230kV TRANSFORMER 2
SHIPROCK 345/230kV TRANSFORMER 1	330.00	368.91	112.4%	FOURCORNERS to MOENKOPI 500kV LINE

## ***Appendix E – Transient Stability List***

### **500kV Outage List**

- TS1: Three phase fault at Browning 500kV bus and outage of Browning-Silverking 500kV line
- TS2: Three phase fault at Browning 500kV bus and outage of Browning-Kyrene 500kV line
- TS3: Three phase fault at Browning 500kV bus and outage of Browning 500/230kV transformers# 1 &2
- TS4: Three phase fault at Coronado 500kV bus and outage of Coronado-Silverking 500kV line
- TS5: Three phase fault at Coronado 500kV bus and outage of Coronado-Sugarloaf 500kV line
- TS6: Three phase fault at Coronado 500kV bus and outage of Coronado 500/345kV transformers
- TS7: Three phase fault at Coronado 500kV bus and outage of Coronado Unit #1
- TS8: Three phase fault at Coronado 500kV bus and outage of Coronado Unit #2
- TS9: Three phase fault at Hassayampa 500kV bus and outage of Hassayampa-Pinal West 500kV line
- TS10: Three phase fault at Hassayampa 500kV bus and outage of Hassayampa-Jojoba 500kV line
- TS11: Three phase fault at Hassayampa 500kV bus and outage of Hassayampa-Palo Verde 500kV line#1
- TS12: Three phase fault at Hassayampa 500kV bus and outage of Hassayampa-Palo Verde 500kV line#2
- TS13: Three phase fault at Hassayampa 500kV bus and outage of Hassayampa-Palo Verde 500kV line#3
- TS14: Three phase fault at Jojoba 500kV bus and outage of Jojoba-Kyrene 500kV line
- TS15: Three phase fault at Jojoba 500kV bus and outage of Hassayampa-Jojoba 500kV line
- TS16: Three phase fault at Kyrene 500kV bus and outage of Kyrene-Browning 500kV line
- TS17: Three phase fault at Kyrene 500kV bus and outage of Kyrene-Jojoba 500kV line
- TS18: Three phase fault at Kyrene 500kV bus and outage of Kyrene 500/230kV transformer#6
- TS19: Three phase fault at Kyrene 500kV bus and outage of Kyrene 500/230kV transformer#7
- TS20: Three phase fault at Kyrene 500kV bus and outage of Kyrene 500/230kV transformer#8
- TS21: Three phase fault at Palo Verde 500kV bus and outage of Palo Verde –Rudd 500kV line
- TS22: Three phase fault at Palo Verde 500kV bus and outage of Hassayampa-Palo Verde 500kV line#1
- TS23: Three phase fault at Palo Verde 500kV bus and outage of Hassayampa-Palo Verde 500kV line#2
- TS24: Three phase fault at Palo Verde 500kV bus and outage of Hassayampa-Palo Verde 500kV line#3
- TS25: Three phase fault at Palo Verde 500kV bus and outage of Palo Verde-Westwing 500kV line #1
- TS26: Three phase fault at Palo Verde 500kV bus and outage of Palo Verde-Westwing 500kV line #2
- TS27: Three phase fault at Palo Verde 500kV bus and outage of Palo Verde Unit#1
- TS28: Three phase fault at Palo Verde 500kV bus and outage of Palo Verde Unit#2
- TS29: Three phase fault at Palo Verde 500kV bus and outage of Palo Verde Unit#3
- TS30: Three phase fault at Pinal Central 500kV bus and outage of Pinal Central 500/230kV transformer#1
- TS31: Three phase fault at Pinal Central 500kV bus and outage of Pinal Central 500/230kV transformer#2
- TS32: Three phase fault at Pinal West 500kV bus and outage of Hassayampa-Pinal West 500kV line
- TS33: Three phase fault at Rudd 500kV bus and outage of Rudd 500/230kV transformers#1&2
- TS34: Three phase fault at Rudd 500kV bus and outage of Rudd 500/230kV transformers#3&4
- TS35: Three phase fault at Silverking 500kV bus and outage of Coronado-Silverking 500kV line
- TS36: Three phase fault at Silverking 500kV bus and outage of Browning-Silverking 500kV line
- TS37: Three phase fault at Silverking 500kV bus and outage of Silverking 500/230kV transformer#1
- TS38: Three phase fault at Sugarloaf 500kV bus and outage of Coronado-Sugarloaf 500kV line
- TS39: Three phase fault at Sugarloaf 500kV bus and outage of Cholla-Sugarloaf 500kV line

### **230kV Outage List**

- TS1: Three phase fault at Abel 230kV bus and outage of Abel-Dinosaur 230kV line  
TS2: Three phase fault at Abel 230kV bus and outage of Abel-Randolph 230kV line  
TS3: Three phase fault at Abel 230kV bus and outage of Abel Unit #4  
TS4: Three phase fault at Abel 230kV bus and outage of Abel 230/69kV Transformer #1  
TS5: Three phase fault at Abel 230kV bus and outage of Abel Unit #5  
TS6: Three phase fault at Abel 230kV bus and outage of Abel-RS24 230kV line #1  
TS7: Three phase fault at Abel 230kV bus and outage of Abel-RS24 230kV line #2  
TS8: Three phase fault at Agua Fria 230kV bus and outage of Agua Fria-Alexander 230kV line  
TS9: Three phase fault at Agua Fria 230kV bus and outage of Agua Fria-White Tanks 230kV line  
TS10: Three phase fault at Agua Fria 230kV bus and outage of Agua Fria-AF North 230/69kV Transformer #3  
TS11: Three phase fault at Agua Fria 230kV bus and outage of Agua Fria-Westwing 230kV line  
TS12: Three phase fault at Agua Fria 230kV bus and outage of Agua Fria-AF North 230/69kV Transformer #4  
TS13: Three phase fault at Agua Fria 230kV bus and outage of Agua Fria Units #4 and #5  
TS14: Three phase fault at Anderson 230kV bus and outage of Anderson-Kyrene-New 230kV line  
TS15: Three phase fault at Anderson 230kV bus and outage of Anderson-Orme 230kV line #2  
TS16: Three phase fault at Anderson 230kV bus and outage of Anderson-Orme 230kV line #1  
TS17: Three phase fault at Anderson 230kV bus and outage of Anderson 230/69kV Transformer #1  
TS18: Three phase fault at Anderson 230kV bus and outage of Anderson 230/69kV Transformer #2  
TS19: Three phase fault at Anderson 230kV bus and outage of Anderson 230/69kV Transformer #3  
TS20: Three phase fault at Anderson 230kV bus and outage of Anderson 230/69kV Transformer #4  
TS21: Three phase fault at Alexander 230kV bus and outage of Alexander- Deer Valley 230kV line  
TS22: Three phase fault at Alexander 230kV bus and outage of Alexander APS Transformer  
TS23: Three phase fault at Alexander 230kV bus and outage of Alexander 230/69kV Transformer #1  
TS24: Three phase fault at Alexander 230kV bus and outage of Alexander 230/69kV Transformer #2  
TS25: Three phase fault at Brandow 230kV bus and outage of Brandow-Kyrene 230kV Line  
TS26: Three phase fault at Brandow 230kV bus and outage of Brandow-Papago Buttes 230kV Line  
TS27: Three phase fault at Brandow 230kV bus and outage of Brandow-Ward 230KV Line #1  
TS28: Three phase fault at Brandow 230kV bus and outage of Brandow-Ward 230KV Line #2  
TS29: Three phase fault at Brandow 230kV bus and outage of Brandow-Pinnacle Peak SRP 230KV Line #1  
TS30: Three phase fault at Brandow 230kV bus and outage of Brandow-Pinnacle Peak SRP 230KV Line #2  
TS31: Three phase fault at Brandow 230kV bus and outage of Brandow 230/69kV Transformer #1  
TS32: Three phase fault at Brandow 230kV bus and outage of Brandow 230/69kV Transformer #2  
TS33: Three phase fault at Brandow 230kV bus and outage of Brandow 230/69kV Transformer #3  
TS34: Three phase fault at Browning 230kV bus and outage of Browning-Santan 230KV Line  
TS35: Three phase fault at Browning 230kV bus and outage of Browning-Dinosaur 230KV Line  
TS36: Three phase fault at Browning 230kV bus and outage of Browning 230/69kV Transformer #4  
TS37: Three phase fault at Browning 230kV bus and outage of Browning 500/230kV Transformers #1 & 2  
TS38: Three phase fault at Corbell 230kV bus and outage of Corbell-Kyrene 230kV line

TS39: Three phase fault at Corbell 230kV bus and outage of Corbell-Santan 230kV line

TS40: Three phase fault at Corbell 230kV bus and outage of Corbell 230/69kV Transformer #2

TS41: Three phase fault at Corbell 230kV bus and outage of Corbell 230/69kV Transformer #3

TS42: Three phase fault at Corbell 230kV bus and outage of Corbell 230/69kV Transformer #4

TS43: Three phase fault at Desert Basin 230kV bus and outage of Desert Basin-Santa Rosa 230kV line

TS44: Three phase fault at Desert Basin 230kV bus and outage of Desert Basin-Pinal Central 230kV line

TS45: Three phase fault at Desert Basin 230kV bus and outage of Desert Basin Combustion Turbine #1

TS46: Three phase fault at Desert Basin 230kV bus and outage of Desert Basin Combustion Turbine #2 and Steam Turbine #1

TS47: Three phase fault at Dinosaur 230kV bus and outage of Dinosaur 230/69kV Transformer #1

TS48: Three phase fault at Goldfield 230kV bus and outage of Goldfield-Silverking 230kV line

TS49: Three phase fault at Goldfield 230kV bus and outage of Goldfield-Thunderstone 230kV line #1

TS50: Three phase fault at Goldfield 230kV bus and outage of Goldfield-Thunderstone 230kV line #2

TS51: Three phase fault at Goldfield 230kV bus and outage of Goldfield 230/115kV Transformer #1

TS52: Three phase fault at Goldfield 230kV bus and outage of Goldfield 230/115kV Transformer #2

TS53: Three phase fault at Knox 230kV bus and outage of Knox-Kyrene-New 230kV line

TS54: Three phase fault at Knox 230kV bus and outage of Knox-Santa Rosa 230kV line

TS55: Three phase fault at Kyrene 230kV bus and outage of Kyrene-Schrader 230kV line

TS56: Three phase fault at Kyrene 230kV bus and outage of Kyrene 230/69kV Transformer #4

TS57: Three phase fault at Kyrene 230kV bus and outage of Kyrene-Corbell 230kV line

TS58: Three phase fault at Kyrene 230kV bus and outage of Kyrene 230/69kV Transformer #2

TS59: Three phase fault at Kyrene 230kV bus and outage of Kyrene 230/69kV Transformer #3

TS60: Three phase fault at Kyrene 230kV bus and outage of Kyrene Units #5 and #6

TS61: Three phase fault at KyreneNew 230kV bus and outage of KyreneNew-Ocotillo 230kV line

TS62: Three phase fault at KyreneNew 230kV bus and outage of KyreneNew-Knox 230kV line

TS63: Three phase fault at KyreneNew 230kV bus and outage of KyreneNew-Papago Buttes 230kV line

TS64: Three phase fault at KyreneNew 230kV bus and outage of KyreneNew-Anderson 230kV line

TS65: Three phase fault at Orme 230kV bus and outage of Orme-Rudd 230kV line #1

TS66: Three phase fault at Orme 230kV bus and outage of Orme 230/69kV Transformer #3

TS67: Three phase fault at Orme 230kV bus and outage of Orme-Rudd 230kV line #2

TS68: Three phase fault at Orme 230kV bus and outage of Orme 230/69kV Transformer #4

TS69: Three phase fault at Orme 230kV bus and outage of Orme 230/69kV Transformer #1

TS70: Three phase fault at Orme 230kV bus and outage of Orme 230/69kV Transformer #2

TS71: Three phase fault at Papago Buttes 230kV bus and outage of Papago Buttes-Pinnacle Peak SRP 230kV line #1

TS72: Three phase fault at Papago Buttes 230kV bus and outage of Papago Buttes 230/69kV Transformer #1

TS73: Three phase fault at Papago Buttes 230kV bus and outage of Papago Buttes 230/69kV Transformer #4

TS74: Three phase fault at Papago Buttes 230kV bus and outage of Papago Buttes 230/69kV Transformer #3

TS75: Three phase fault at Papago Buttes 230kV bus and outage of Papago Buttes 230/69kV Transformer #2

TS76: Three phase fault at Pinal Central 230kV bus and outage of Pinal Central 500/230kV Transformer #1

TS77: Three phase fault at Pinal Central 230kV bus and outage of Pinal Central 500/230kV Transformer #2

TS78: Three phase fault at Pinal Central 230kV bus and outage of Pinal Central-Sun Arizona 230kV line

TS79: Three phase fault at Pinal Central 230kV bus and outage of Pinal Central-Randolph 230kV line

TS80: Three phase fault at Pinnacle Peak SRP 230kV bus and outage of Pinnacle Peak SRP-Pinnacle Peak WAPA 230kV line #1

TS81: Three phase fault at Pinnacle Peak SRP 230kV bus and outage of Pinnacle Peak SRP-Pinnacle Peak WAPA 230kV line #2

TS82: Three phase fault at Pinnacle Peak SRP 230kV bus and outage of Pinnacle Peak-Deer Valley 230kV line

TS83: Three phase fault at Pinnacle Peak SRP 230kV bus and outage of Pinnacle Peak SRP-Pinnacle Peak APS 230kV line #1

TS84: Three phase fault at Pinnacle Peak SRP 230kV bus and outage of Pinnacle Peak SRP-Pinnacle Peak APS 230kV line #2

TS85: Three phase fault at Pinnacle Peak SRP 230kV bus and outage of Pinnacle Peak SRP-Papago Buttes 230kV line

TS86: Three phase fault at Randolph 230kV bus and outage of Randolph Units #9 and #10

TS87: Three phase fault at Randolph 230kV bus and outage of Randolph Units #11 and #12

TS88: Three phase fault at Randolph 230kV bus and outage of Randolph Units #1 and #2

TS89: Three phase fault at Randolph 230kV bus and outage of Randolph Units #3 and #4

TS90: Three phase fault at Randolph 230kV bus and outage of Randolph Units #5 and #6

TS91: Three phase fault at Randolph 230kV bus and outage of Randolph Units #7 and #8

TS92: Three phase fault at Rogers 230kV bus and outage of Rogers-Thunderstone 230kV line

TS93: Three phase fault at Rogers 230kV bus and outage of Rogers 230/69kV Transformer #2

TS94: Three phase fault at Rogers 230kV bus and outage of Rogers 230/69kV Transformer #4

TS95: Three phase fault at Rudd 230kV bus and outage of Rudd-Liberty 230kV line

TS96: Three phase fault at Rudd 230kV bus and outage of Rudd-White Tanks 230kV line

TS97: Three phase fault at Rudd 230kV bus and outage of Rudd-West Phoenix 230kV line

TS98: Three phase fault at Rudd 230kV bus and outage of Rudd-Orme 230kV line #1

TS99: Three phase fault at Rudd 230kV bus and outage of Rudd-Orme 230kV line #2

TS100: Three phase fault at Schrader 230kV bus and outage of Schrader-Santan 230kV line

TS101: Three phase fault at Schrader 230kV bus and outage of Schrader 230/69kV Transformer #1

TS102: Three phase fault at Schrader 230kV bus and outage of Schrader 230/69kV Transformer #3

TS103: Three phase fault at Silverking 230kV bus and outage of Silverking 230/115kV Transformer #2

TS104: Three phase fault at Silverking 230kV bus and outage of Silverking 230/115kV Transformer #1

TS105: Three phase fault at Santan 230kV bus and outage of Santan-Thunderstone 230kV line

TS106: Three phase fault at Santan 230kV bus and outage of Santan 230/69kV Transformer #3

TS107: Three phase fault at Santan 230kV bus and outage of Santan 230/69kV Transformer #4

TS108: Three phase fault at Santan 230kV bus and outage of Santan 230/69kV Transformer #5  
 TS109: Three phase fault at Santan 230kV bus and outage of Santan Units #1 and #3  
 TS110: Three phase fault at Santan 230kV bus and outage of Santan Unit #5  
 TS111: Three phase fault at Santan 230kV bus and outage of Santan Unit #6  
 TS112: Three phase fault at Thunderstone 230kV bus and outage of Thunderstone 230/69kV Transformer #1  
 TS113: Three phase fault at Thunderstone 230kV bus and outage of Thunderstone 230/69kV Transformer #2  
 TS114: Three phase fault at Thunderstone 230kV bus and outage of Thunderstone 230/69kV Transformer #3  
 TS115: Three phase fault at Thunderstone 230kV bus and outage of Thunderstone 230/69kV Transformer #4  
 TS116: Three phase fault at White Tanks 230kV bus and outage of White Tanks 230/69kV Transformer #1  
 TS117: Three phase fault at White Tanks 230kV bus and outage of White Tanks 230/69kV Transformer #3

#### **115kV Outage List**

TS1: Three phase fault at Asarco and outage of Asarco-Asarco Tap 115kV line, Asarco Tap-Hayden 115kV line and Asarco Tap-Crusher 115kV line  
 TS2: Three phase fault at Carlotta and outage of Carlotta-Pinto Valley 115kV line, Carlotta-Silverking Tap #2 115kV line, Silverking Tap #2-Superior 115kV and Silverking 230/115kV Transformer #2  
 TS3: Three phase fault at Carrel and outage of Carrel-Goldfield 115kV line and Carrel-Spurlock 115kV line  
 TS4: Three phase fault at Crusher and outage of Crusher-Bonneybrook Tap 115kV line and Bonneybrook Tap-Coolidge 115kV line  
 TS5: Three phase fault at Crusher and outage of Asarco-Asarco Tap 115kV line, Asarco Tap-Hayden 115kV line and Asarco Tap-Crusher 115kV line  
 TS6: Three phase fault at Ellison and outage of Ellison-Gas Cleaning Tap 115kV line, Gas Cleaning Tap-Gas Cleaning 115kV line, Gas Cleaning Tap-Miami 115kV and Gas Cleaning Tap-Refinery 115kV line  
 TS7: Three phase fault at Frazier and outage of Frazier-Moonshine 115kV line  
 TS8: Three phase fault at Frazier and outage of Frazier-Roosevelt 115kV line and Roosevelt Unit  
 TS9: Three phase fault at Frazier and outage of Frazier-Horse Mesa 115kV line  
 TS10: Three phase fault at Goldfield and outage of Goldfield-Horse Mesa 115kV line  
 TS11: Three phase fault at Goldfield and outage of Goldfield-Mormon Flat 115kV line, Goldfield-Stewart Mountain 115kV line and Stewart Mountain Unit  
 TS12: Three phase fault at Goldfield and outage of Goldfield-Carrel 115kV line and Carrel-Spurlock 115kV line  
 TS13: Three phase fault at Hayden and outage of Hayden-Kearny Tap 115kV line, Kearny Tap-Kearny 115kV line, Kearny Tap-Morris 115kV and Morris-Knoll 115kV line  
 TS14: Three phase fault at Hayden and outage of Asarco-Asarco Tap 115kV line, Asarco Tap-Hayden 115kV line and Asarco Tap-Crusher 115kV line  
 TS15: Three phase fault at Horse Mesa and outage of Horse Mesa-Mormon Flat 115kV line

TS16: Three phase fault at Horse Mesa and outage of Horse Mesa-Goldfield 115kV line

TS17: Three phase fault at Horse Mesa and outage of Frazier-Horse Mesa 115kV line

TS18: Three phase fault at Horse Mesa and outage of Horse Mesa Units #1, #2 and #3

TS19: Three phase fault at Horse Mesa and outage of Horse Mesa Units #4

TS20: Three phase fault at Knoll and outage of Hayden-Kearny Tap 115kV line, Kearny Tap-Kearny 115kV line, Kearny Tap-Morris 115kV and Morris-Knoll 115kV line

TS21: Three phase fault at Knoll and outage of Knoll-Ray 115kV line and Ray-Superior 115kV line

TS22: Three phase fault at Kearny and outage of Hayden-Kearny Tap 115kV line, Kearny Tap-Kearny 115kV line, Kearny Tap-Morris 115kV and Morris-Knoll 115kV line

TS23: Three phase fault at Mormon Flat and outage of Horse Mesa-Mormon Flat 115kV line

TS24: Three phase fault at Mormon Flat and outage of Mormon Flat Units #1 and #2

TS25: Three phase fault at Mormon Flat and outage of Goldfield-Mormon Flat 115kV line, Goldfield-Stewart Mountain 115kV line and Stewart Mountain Unit

TS26: Three phase fault at Miami and outage of Miami-Pinto Valley 115kV line

TS27: Three phase fault at Miami and outage of Miami-Pinal 115kV line

TS28: Three phase fault at Moonshine and outage of Moonshine-Pinal 115kV line

TS29: Three phase fault at Moonshine and outage of Ellison-Gas Cleaning Tap 115kV line, Gas Cleaning Tap-Gas Cleaning 115kV line, Gas Cleaning Tap-Miami 115kV and Gas Cleaning Tap-Refinery 115kV line

TS30: Three phase fault at Moonshine and outage of Frazier-Moonshine 115kV line

TS31: Three phase fault at Morris and outage of Hayden-Kearny Tap 115kV line, Kearny Tap-Kearny 115kV line, Kearny Tap-Morris 115kV and Morris-Knoll 115kV line

TS32: Three phase fault at Oakflat and outage of Oakflat-Silverking Tap #1 115kV line and Silverking Tap #1-Pinal 115kV line

TS33: Three phase fault at Oakflat and outage of Oakflat-Trask 115kV line and Trask-Superior 115kV line

TS34: Three phase fault at Pinal and outage of Oakflat-Silverking Tap #1 115kV line and Silverking Tap #1-Pinal 115kV line

TS35: Three phase fault at Pinal and outage of Moonshine-Pinal 115kV line

TS36: Three phase fault at Pinal and outage of Miami-Pinal 115kV line

TS37: Three phase fault at Pinto Valley and outage of Miami-Pinto Valley 115kV line

TS38: Three phase fault at Pinto Valley and outage of Carlotta-Pinto Valley 115kV line, Carlotta-Silverking Tap #2 115kV line, Silverking Tap #2-Superior 115kV and Silverking 230/115kV Transformer #2

TS39: Three phase fault at Ray and outage of Knoll-Ray 115kV line and Ray-Superior 115kV line

TS40: Three phase fault at Roosevelt and outage of Frazier-Roosevelt 115kV line and Roosevelt Unit

TS41: Three phase fault at Silverking #1 and outage of Oakflat-Silverking Tap #1 115kV line, Silverking Tap #1-Pinal 115kV line and Silverking 230/115kV Transformer #1

TS42: Three phase fault at Silverking #2 and outage of Carlotta-Pinto Valley 115kV line, Carlotta-Silverking Tap #2 115kV line, Silverking Tap #2-Superior 115kV and Silverking 230/115kV Transformer #2

TS43: Three phase fault at Spurlock and outage of Superior-Spurlock 115kV line

TS44: Three phase fault at Spurlock and outage of Carrel-Goldfield 115kV line and Carrel-Spurlock 115kV line

TS45: Three phase fault at Superior and outage of Oakflat-Trask 115kV line and Trask-Superior 115kV line

TS46: Three phase fault at Superior and outage of Knoll-Ray 115kV line and Ray-Superior 115kV line  
TS47: Three phase fault at Superior and outage of Carlotta-Pinto Valley 115kV line, Carlotta-Silverking Tap #2 115kV line, Silverking Tap #2-Superior 115kV and Silverking 230/115kV Transformer #2  
TS48: Three phase fault at Superior and outage of Superior-Spurlock 115kV line  
TS49: Three phase fault at Stewart Mountain and outage of Goldfield-Mormon Flat 115kV line, Goldfield-Stewart Mountain 115kV line and Stewart Mountain Unit  
TS50: Three phase fault at Trask and outage of Oakflat-Trask 115kV line and Trask-Superior 115kV line

## ***Appendix F – Transient Stability Plots***

The results for the Transient Stability will be made available upon request.